

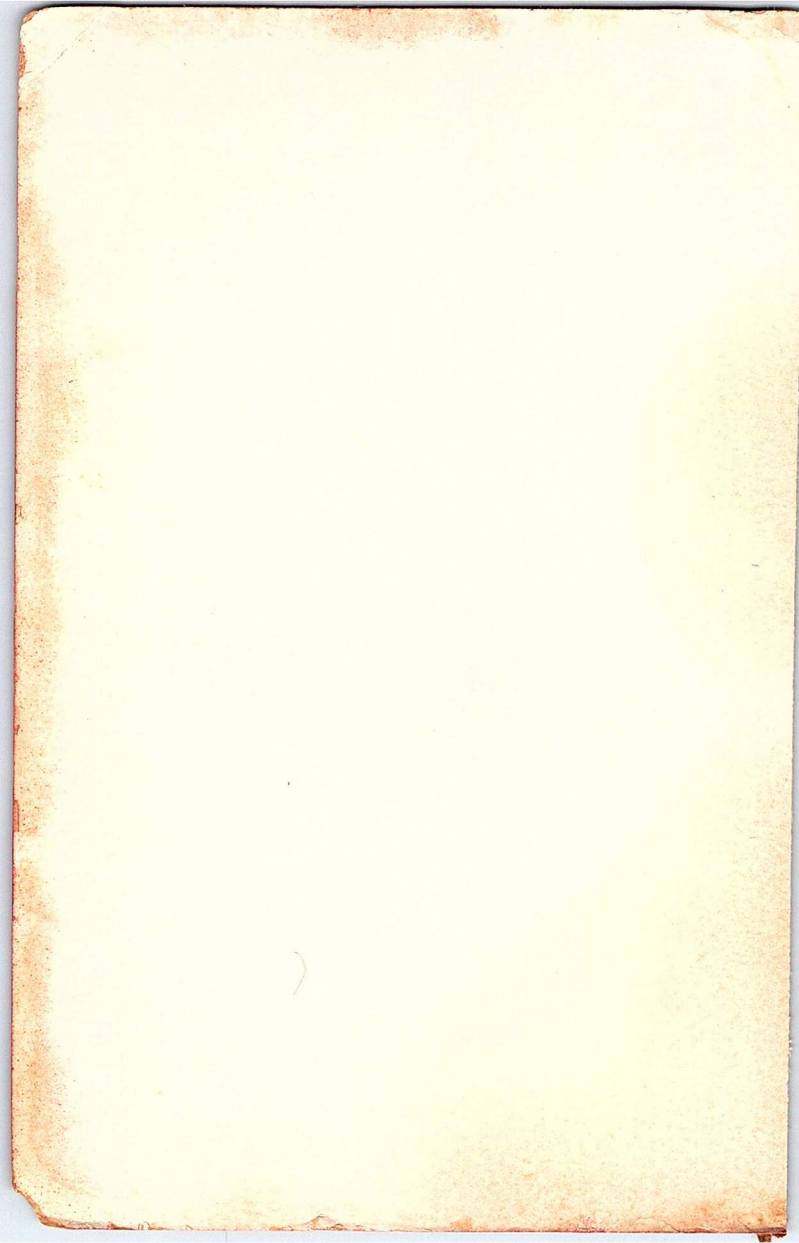
HOW TO WORK WITH TOOLS & WOOD

A do-it-yourself guide for
the beginner, the home
craftsman, the handyman
or the homeowner.

Edited by
FRED GROSS, Manager, Educational Department
for Stanley Tools

OVER
400
ILLUSTRATIONS
AND DIAGRAMS






All You Want to Know About

HOW TO WORK WITH TOOLS AND WOOD

This book is practical and basic. It has been compiled by a man who has spent a lifetime testing his theories at the workbench. Everything in it "WORKS!" As Mr. Gross, the editor, who is also manager of the Educational Department for Stanley Tools, points out, "With a fair knowledge of how to use tools anyone can do home-repair jobs and actually make simple or even elaborate things. This book has been written to give anyone that knowledge."

What you learn in this book will be immensely profitable both in terms of money and enjoyment. It will teach you to make things that would cost five to six times as much if purchased. It shows you how to use hardware, chisels, files; how to hang a door, polish, finish, apply enamel, varnish and stain, make the simplest and most complicated joints; plus hundreds more facts and tips about tools and wood. But for a good idea of how you can profit from this book we suggest you start reading or glance through the complete index.

HOW TO WORK WITH

POCKET  BOOKS, INC. • NEW YORK, N. Y.

TOOLS

and

WOOD

Edited by FRED GROSS

**MANAGER, EDUCATIONAL DEPARTMENT FOR
STANLEY TOOLS**

This Pocket Book is a revised and enlarged edition of the original, higher-priced book. It is printed from brand-new plates made from completely reset, clear, easy-to-read type.

HOW TO WORK WITH TOOLS AND WOOD

Stanley Tools edition published 1952

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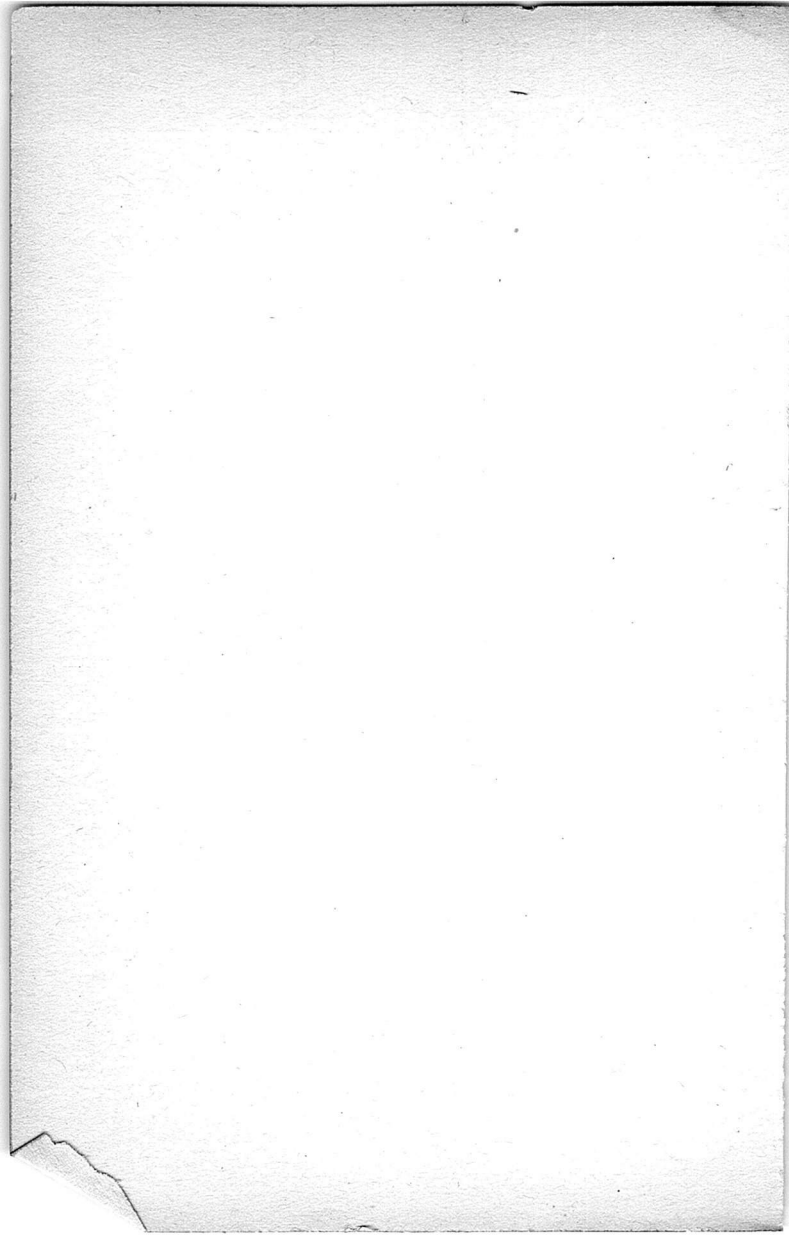
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HOW TO WORK WITH

TOOLS and WOOD



CHAPTER ONE

All of Us Can Use Tools

NEVER IN MY BOYHOOD was I permitted to touch clean, new wood with sharp tools. My family had the notion that my fingers were all thumbs.

I remember as a very little boy standing in a lumberyard, feeling pieces of clean, smooth, white pine, looking longingly at a fine board about 16 feet long, and wanting it almost more than anything I ever had seen before.

There were other times when I stood for hours with my nose pressed against the glass of the show window of a hardware store, dreaming of myself at a workbench with all the planes, the saws, the rules, the chisels, the hammers, the screwdrivers that I could possibly want. But I did not ask for them because I had been made to feel that sweet smelling lumber was for boys and men who knew how to use it, not for those who had no "talent."

Resigned but discontented I grew up believing there was a great mystery, for instance, about hanging a door. I have seen carpenters breathe on the hinges which they were about to screw into position with the idea that it brought them good luck and that the doors as a result would hang well. It isn't true, of course. There is no mystery about hanging a door. You don't need good luck. You only need to know how to do it, provided you have good tools, well sharpened. Today, I

HOW TO WORK WITH TOOLS AND WOOD

believe, I could teach my fifteen-year-old boy in two lessons how to hang a door.

It wasn't until I became a husband and a householder that I got myself a tool chest. Talk about it being my hope chest! I learned to put up shelves, hang a door, put new locks on windows and cupboards and build very satisfactory pieces of simple furniture. Most important, however, is something else I learned—I learned that even a big job, such as building a kitchen cabinet, is not a mysterious and wonderfully complex task. It is not a battle with wood. It does not require a mysterious and occult knowledge.

I discovered that you do not stand over a pile of lumber with a saw, a plane and a chisel in your hand and say "hocus-pocus." On the contrary what you actually do is take a small board of the proper kind of wood, make it the right length and the right width and join it to another small piece which you have put through the same process. You keep on doing this, occasionally erecting three or four of the pieces you have put together. When you get through with the job, after a few hours' labor, you have what is called a kitchen cabinet. It is not a kitchen cabinet until you have put it all together and erected it in place. It is a collection of pieces of board, sawed and planed to fit together in various ways.

Really it's as simple as $1+1+1+1=4$.

So I learned that making anything out of wood is like doing any other job; you need to know a little bit about it, have the proper tools to do it, and then do it little by little and piece by piece.

That is all there is to making anything of wood.

Things Made by Hand Can Be Beautiful

Not very long ago I made a lucky purchase. It was a little Jacobean stool, the kind they used to have three hundred years ago in England for small boys and girls. It is made of oak, well worn from countless small shoes and trousers. It is, I believe, more beautiful than any modern stool I could buy

ALL OF US CAN USE TOOLS

today in a store. The reason is that it is well made *by hand*, is simple and rugged in design, is made of excellent materials, and the wood has acquired the beautiful color the years have brought to it.

But there is no reason why a kitchen shelf cannot be fundamentally beautiful, too. There is no reason why a door cannot be hung so that it swings at the touch of a hand and be beautiful because it is simple and rugged.

If you learn to make an ordinary mortise, to form a dovetail joint, a halved joint, or to plane the edge of a board so that it is square; if you learn to drive a nail straight, to put heavy screws in oak without splitting the board, and handles on a drawer so that they are straight, your work in wood can be beautiful, too.

You can go to a store and buy a kitchen cabinet ready for use, well painted, for \$50 or \$60. You can make that kitchen cabinet yourself in the evenings for not over \$10. You can go to a store and buy a candlestick, varnished and polished, for from 10 cents to \$5.00. You can make that candlestick yourself with perhaps no saving in money. But when you have made it and it is standing on the mantelpiece you will always have before you the memory of a sharp tool cutting into well seasoned wood. Through your hands, and your hands alone, the world is the richer by the existence of that object.

That is the satisfaction which the artist, the writer, or the craftsman in steel, stone, glass or wood feels. There is something priceless about it. You have a value that no man can take from you. Let the candlestick become blackened and charred, let it be broken by careless hands and still the joy of its creation cannot be taken from you, it is yours for the length of your life.

CHAPTER TWO

How to Become Skillful

CRAFTSMANSHIP is a combination of knowledge of how to use tools and of skill with the hands. An old cabinet-maker or carpenter knows more tricks of the trade than he could possibly teach. These tricks are a part of the day's work. They come from many hours of cut and try and trial and error. But you can start today and in half an hour learn all by yourself several fascinating things about tools and wood. If you take a plane to a piece of white pine you will soon discover that when you attempt to push the tool against the grain you don't make a smooth cut, yet when you push the plane with the grain you do. With a sharp plane, it is almost as smooth as though you had used sandpaper.

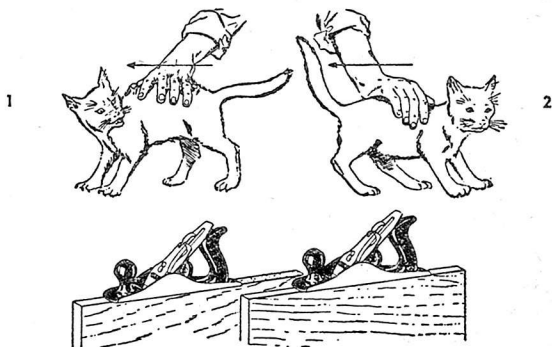
Lesson One. You have learned never to plane a piece of wood until you have examined it to see which way the grain runs. Always plane with the grain unless you have a special finishing job requiring a special type of work.

The other factor in craftsmanship is skill with the hands. To become a skilled workman in wood requires practice for two reasons: first, you learn to handle tools delicately and firmly, as a pianist learns to strike the notes on his keyboard to produce precisely the effect he wishes; second, you learn by trial and error the best ways of using your hands.

There is no real short cut to craftsmanship. You can learn a great deal about life and business from a kit of tools and

HOW TO BECOME SKILLFUL

some wood: patience, perseverance, how to analyze a problem, and the joy of doing a job right.



1. Planing against the grain roughs the wood like stroking a cat's fur the wrong way.
2. Planing with the grain leaves the wood sleek and smooth.

What This Book Can Do

No book can possibly give you *all* the tricks of good carpentry. They have to be learned at the bench. But this volume will give you fundamentals which will enable you to get the most fun out of tools and to achieve the most skill.

Many professional men and businessmen have found woodworking a wonderful source of relaxation from the stress and strain of their busy life.

And most important of all, by using this book to help you make things at home, you will be adding to the richness of your own life.

CHAPTER THREE

Let's Make Something

HAVE YOU EVER SAT behind a portrait painter or watched a sign painter working on a billboard? He walks boldly up to his canvas or board, cocks his head on one side, then, glancing at his model or a sketch of the design which he is going to reproduce his eyes travel back to the space where the picture is to be. Suddenly he makes a long sweeping mark with his brush. The mark seems utterly meaningless to most of us. So is the second splash of paint and probably the third and the fourth. To most of us what he is doing is an utter mystery until his design appears perhaps half completed. It is a common vaudeville act for an artist to stand on the stage and draw a series of lines, completely mystifying his audience until the last line is made. Then suddenly the picture, upon the completion of that last line, jumps into being and you recognize at once what it is he has created.

Watching a cabinetmaker you find that precisely the same thing happens. When he starts to make a chair he selects a piece of wood, examining it carefully. His next step is to take a pencil and put lines on the piece of wood. Then he places it in a vise, picking up a plane about 14 inches long and slicing off long, thin shavings of spicy wood. At this stage no one on earth, unless he were a mind reader, would know what he was planning to do. But rest assured that there is in the

LET'S MAKE SOMETHING

worker's mind a very definite plan, that he knows exactly what he is doing. He knows how long the legs of the chair will be, how wide and how deep the seat will be, the dimensions he is going to use and the shape of the chair; he knows what joints will be required, what screws he will need, and when he is ready to use the glue. The chair, or the stool, or the table, or the window frame, which he is about to construct has already been designed. Being an experienced craftsman, he will not cut into clean wood until he knows *exactly* what he is going to do.

Lesson Two: Never start to work until you have an exact plan. Even if you are merely making a simple shelf you should put on paper a rough drawing of what you are going to make before you turn the first shaving. If you are "eye-minded" you will have no difficulty in drawing a little picture of the shelf and marking on it the measurements to fit the space for which you are designing it. If you are not "eye-minded" you can accomplish much the same result by listing the various pieces of wood in the project, with the dimensions you wish them to have when they are done.

Obviously the shelf must have a certain width and a certain length. It must have something to hold it in place: metal shelf brackets or wooden brackets which you yourself make. Your shelf must be a little wider than the brackets. There must be screws or nails to fasten the shelf to the bracket and to fasten the bracket to the wall. The brackets must take a certain position. They must go into solid wood for they will not hold well in plaster. Tap the wall and locate the solid wood and the hollow places behind the plaster.

Settle all your problems of design in advance. You may add decorations to your shelf after it is ready to put up, such as chamfered corners, but changes in its basic design may result in a poor job and a great deal of extra work if they are made after the shelf is started.

After you have made your design with dimensions, you need next to choose a wood which is suitable for the purpose. For the inexperienced amateur there is no wood in the world

HOW TO WORK WITH TOOLS AND WOOD

which is more fun to work with, more satisfactory in the results obtained, than white pine. Next to this comes poplar, called whitewood. Both are comparatively inexpensive. You may find there are woodworking plants in your neighborhood where you can pick up scraps at very little cost. If you are going to put up a shelf, you require a board large enough to cut down to the dimensions you intend to use.

I suggest white pine because it can be obtained in clear stock. Clear stock is so named because it has no knots. (For some projects small tight knots in the wood may not be objectionable.) Its grain is quite straight and the wood quite soft. It does not splinter easily. With sharp tools it cuts as nicely as cheese. It has good structural strength, too.

The tools for a simple household-task like making a shelf are the same tools required for making a bench or even a kitchen cabinet. Almost every one of these tools is really essential for the home carpenter.

Even if you have never done woodwork, you probably have some of the required tools around the house. Inspect them carefully. You may find some practically useless; after all, they probably have been used by many hands for many years. Others can easily be put into apple pie order. Perhaps a few new parts, a good sharpening, or a careful cleaning and oiling will put them right back in business. Fix up those which can be repaired. Then, make this promise to yourself, "from now on, I'm going to have a place for my tools."

Keep them in a tool chest—their respected domicile—to protect them from dirt and dust.

If you're starting from scratch, the best thing to do, of course, is to purchase a standard tool set in a chest. It will serve you well for your lifetime. Or you can make your own tool chest and equip it piece by piece.

A tool set containing everything you need for working around a house, putting up shelves, making a cabinet, repairing a cellar door or bracing a roof, may cost about \$50, including a chest for keeping the tools in their proper places. Such a chest can be bought at almost any hardware store.

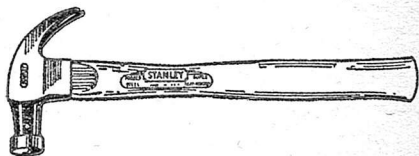
LET'S MAKE SOMETHING

Do not make the mistake of buying low-priced inferior tools. You will immediately handicap yourself; they may not do the job. Cutters may not hold a keen edge and you will become discouraged and blame yourself when the trouble is really a poor tool. A good tool is an important investment. It will pay dividends for years to come.

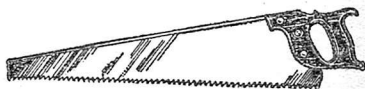
Good craftsmen need good tools. An inexperienced person cannot expect to do a good job with inferior tools.

If you want to select your own individual tools instead of a set, you'll find a list of primary tools you should have on the following pages. Start with the first ten or more and add to your set as you need them.

Claw Hammer, 13-oz.



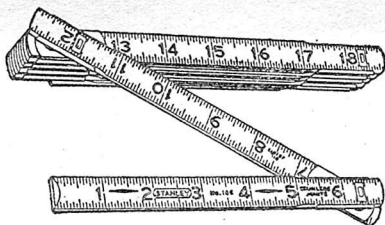
Handsaw, crosscut, 22" or 24" blade, 10 point



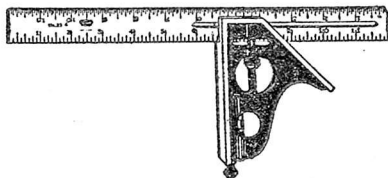
Plane, Junior Jack, 11½", or Jack, 14"



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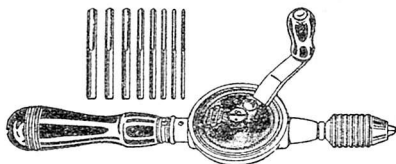
Rule, 6' Zigzag



Square, Combination, 12"

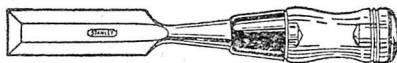


Screwdriver, 4" blade



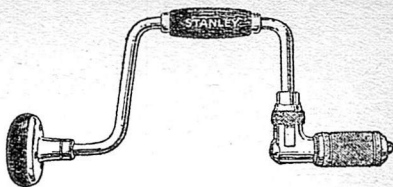
Hand Drill with drills

*Chisels, $\frac{1}{4}$ ", $\frac{3}{4}$ " width
(Add other widths as needed
 $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{7}{8}$ ", 1"
and $1\frac{1}{4}$ ")*



LET'S MAKE SOMETHING

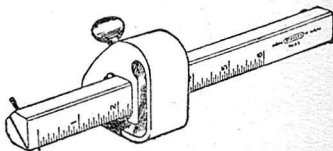
Bit Brace 10" sweep



Auger Bits, $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", diameter, Russell Jennings No. 100 (Add other diameters as needed: $\frac{9}{16}$ ", $\frac{5}{8}$ ", $\frac{11}{16}$ ", $\frac{13}{16}$ ", $\frac{7}{8}$ " and $1\frac{1}{8}$ ")



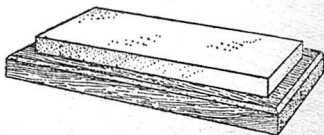
Marking Gauge



Nail Sets, $\frac{2}{32}$ " and $\frac{4}{32}$ " point

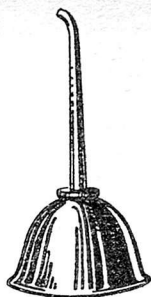


Combination Oilstone, 8" x 2" x 1"

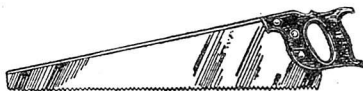


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Oiler



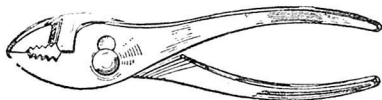
*Handsaw, Rip, 24" or 26"
blade, 5 point*



*Screwdriver, 6" thin
blade*



Pliers, Combination 6"

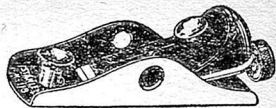


Bit Gauge



LET'S MAKE SOMETHING

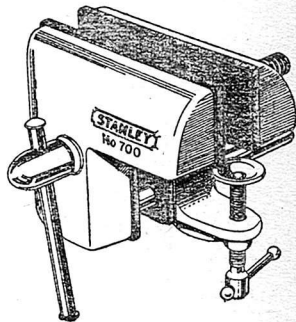
Plane, Block, 6"



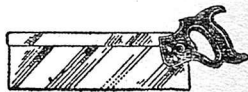
Screwdriver Bits, $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ " tips



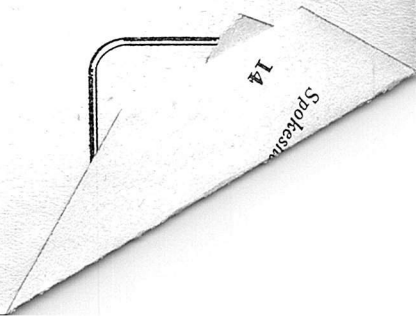
Woodworking Vise



Backsaw, 12" blade, 14 point



Coping Saw



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Knife, with extra blades



File, Half-Round Cabinet, 10"



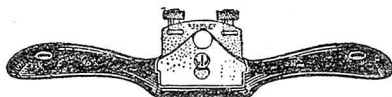
Awl, Brad, 1½" blade



Countersink



Plane



LET'S MAKE SOMETHING

As you learn to use these tools and have the urge to do more with them, you will realize the importance of having a workbench. Without one you will not be able to do the kind of work that will satisfy you. For this reason a later chapter is devoted to the building of a bench.

Perhaps, too, you may someday plan a complete workshop in your basement, attic, garage or the new home you may want to build. This can be a big thrill for the years ahead. You can make your own benches, cabinets, and storage racks. Later you can add machines and power tools. In this way, your home workshop can grow gradually. It is more fun that way. Plan ahead and spread the cost over several Christmas, birthday, or anniversary presents. You will have something worth while which will add to your future happiness.

All this can be for the future as you progress in this interesting hobby.

But right now, let's stick to basics. Let's think a little more about making "one piece at a time." Let's find out what a working drawing is all about.

In the next chapter, we will actually make a working drawing for a simple, basic project—a bookrack.

First you will learn to picture in your mind how you will make this bookrack, "one piece at a time."

This simple principle can lead you to many other projects in wood. It may open the door to a wonderful hobby in creating things you can be proud of all your life.

Look at the next chapter and see how we take the first step. Here's where the fun begins.

CHAPTER FOUR

Taking It from a Working Drawing

WHATEVER WE DECIDE to make, be it a bookrack, a bookcase, a chest of drawers, or a shelf in the kitchen, we meet the same kind of problems. The success of any piece of work is dependent, of course, on the skill and care used in following the design. The final result is, nevertheless, dependent upon the design and upon the skill with which its various parts have been handled. Obviously if you have a bad drawing to follow your result will be bad, no matter how skillful you are with your joints and your plane surface, no matter how fine the stock you use, no matter how perfectly you use your hardware.

Some people have a flair for design and automatically produce well constructed ideas which they can then translate into wood. These people are natural observers of detail. They don't have to think about it, but there is no reason why the rest of us can't become quite passable designers of whatever things we want to make. Moreover, if we originate designs ourselves, we learn very quickly how to take other people's designs from their working drawings with speed and ease. But the real importance of making your own design is that it's the most fun. There is something magical about conceiving the simplest picture frame, a screen door or a bookrack, making a sketch, deciding upon the kinds of joints you are going to use, the kinds of wood, and the fasteners, and

TAKING IT FROM A WORKING DRAWING

then proceeding to translate your creation into something lasting. That is the real source of the woodworker's joy.

An artist must study design from many points of view and it takes him a lifetime. The worker in wood can learn in a few short months at the bench most of what he needs to know. One of the things is that every design he makes must have balance. That is the most important lesson. A design executed in wood which lacks balance will probably tip over in the slightest breeze, or while carrying the slightest load. A chair needs to have an almost equal amount of weight on each of its four legs. It is this principle which runs not only through useful articles but also through decorative articles. A picture which has all its "weight" on one side as, for instance, a bowl of fruit placed away over to the left, with a broad expanse of table to the right, will always look tipsy and displease every person who looks at it.

There are other points that are of value in design—rhythm, tone values, harmony, and contrast. But for the first few years in which we are working in wood we should be concerned mostly with strength and stability: balance. The other points can rest with your natural way of seeing things until you find that you want to study wood carving, furniture design, free-hand drawing, and the other fascinating arts which your interest in woodworking can lead you to.

We can therefore forget "perspective" drawings and deal only with plan drawings. It is enough to know that a perspective drawing is merely a way of putting on paper what a finished object looks like to the eye from a distance. Plans are just straight diagrams intended to show you the dimensions and actual size and shape of the object you are interested in.

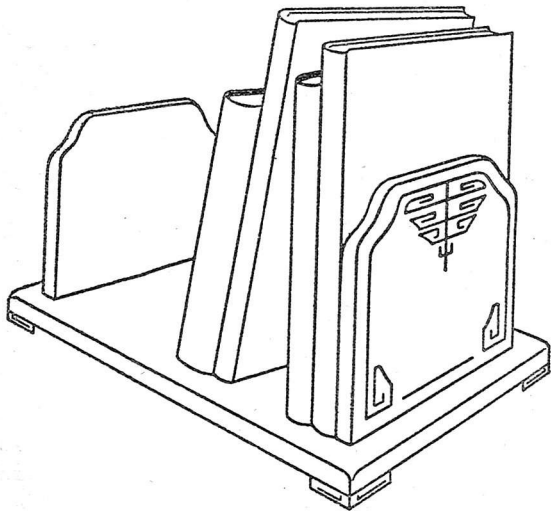
This means that the plan must give you "three dimensional values." That is the technician's involved way of saying that your plan must show thickness, width, and length. It must show you those dimensions for every single stick that goes to make your product; it must show you the size and shape of your mortises, your tenons, and even the hardware which you are going to use.

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A working drawing, the first time you see one, looks like the scratching of a hen in wet sand. The easiest way to learn how to take anything off a working drawing is to sit down and make one and then to go on and build the article which you have designed.

Suppose, as an experiment, you were to make a little bookrack to hold this volume on your bench, as well as a catalogue of tools with the various tables of screw sizes, metric system, weights and measures, board measure, weights, etc. The simplest design is by far the most appropriate.

This bookrack has only seven pieces when it is done.



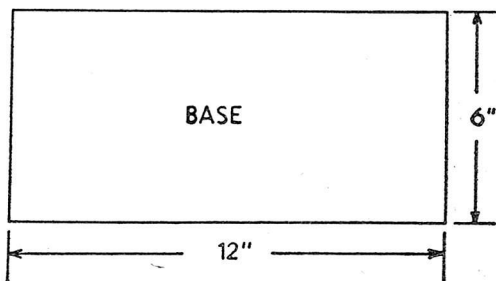
It will be easy to balance this design because a bookrack has two ends and a flat plate upon which the books sit. It balances automatically because the weight is evenly distributed throughout. It would also be a good idea to put feet on the bottom plate so it will stand up above your bench surface.

TAKING IT FROM A WORKING DRAWING

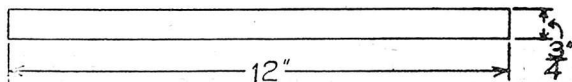
Then you can put your fingers under the edge if you want to lift and move the whole thing.

How wide should you make it? The answer is easy. The average book is about 5" wide when it is closed. Therefore, if you make the plate 6" wide it will accommodate almost any books you want. You won't want many books on your bench, so if your rack is 12" over all in length it should be plenty. Since the bookrack base is to be 12" long, making it just half as wide puts it in splendid proportion, the proportion of 12 to 6—that is, 2 to 1. For some reason the human eye enjoys simple proportions—those that can be reduced to the relationship of one to two, one to three, two to three, three to four, and a few others.

It is very easy to decide the design of your bottom plate then. Make it 6" x 12". Draw a rectangle on a piece of paper with these dimensions, like the drawing below.

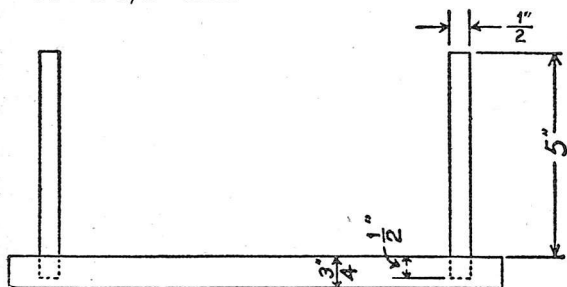


Remember the sizes in which wood comes from the lumber dealer—the 1" thickness, when dressed, is $13/16$ ". Allow a little for planing smooth and we have $3/4$ ", which will be convenient and plenty strong enough. Therefore, you have at once the side view of this bottom board. It looks like this:



HOW TO WORK WITH TOOLS AND WOOD

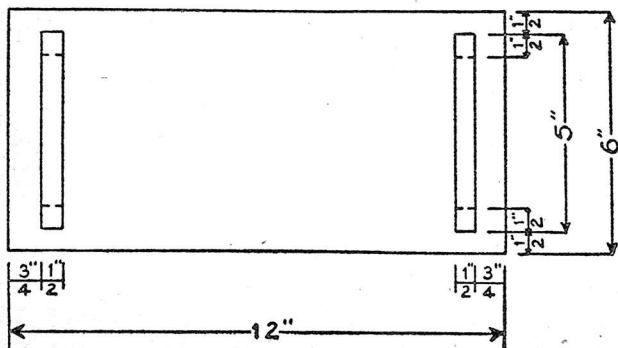
The book ends themselves should be added to the base. They will be high enough if they extend 5" above the base. They need not be as thick as the base so we will plan to plane them down to $1\frac{1}{2}$ " thick.



You see those dotted lines at the bottom of the book ends? They show the kind of joint between the book ends and the base. It is easy to make. It is easy to draw. It will be strong enough to hold your books.

The reason the lines are dotted is that you cannot see the joint when the bookrack is done, but on the drawing dotted lines should show that both these joints are there.

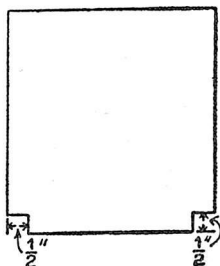
On the top view I must show the two book ends. Remember that when you look down on the bookrack from straight



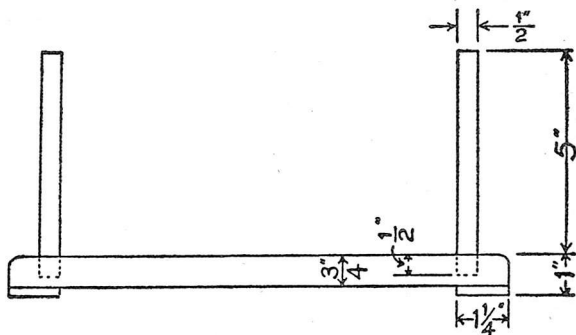
TAKING IT FROM A WORKING DRAWING

above, the book ends will become merely lines on top of the drawing, as on page 20.

Again you notice some dotted lines. They show the hidden joint between the book ends and the base. They also show that the tenon (the part of the book end that goes into the base) is narrower than the book end itself. The purpose of this is to have the book end cover up the joint as well as possible so that when the rack is all done and you are looking at it from any point the joint will be completely concealed.



From the diagram at the bottom of page 20, you will see also that the book ends are square—always a pleasing proportion. Below is a complete front view of our bookrack.



Did you notice one thing that I haven't spoken of? The edges of the board are rounded. This is one of those fancy

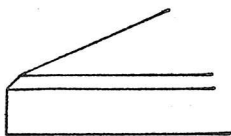
HOW TO WORK WITH TOOLS AND WOOD

touches that one always uses his own judgment about. I happen to like it better this way. Rounded edges can be made by first chamfering with a plane and then rounding with sandpaper, or else with a little cornering tool, shown below, that is finger-shaped.



Edge rounded with cornering tool used only with the grain.

If you prefer a chamfer, draw that on your sketch.



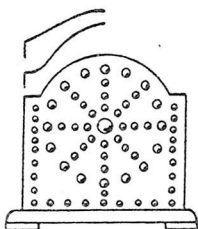
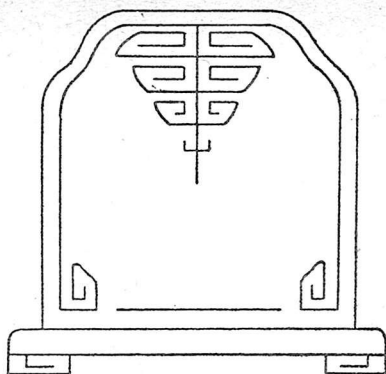
Chamfered edge.

I have also added feet. They can be plain little blocks of wood. The important thing is that they should be broad enough not to be tippy. An inch and a quarter square by one-quarter inch thick would be plenty.

Now you have designed the structure of a bookrack complete with all its dimensions. Any woodworker could take this drawing and produce a duplicate of the bookrack without ever seeing a model.

I have not, however, shown what can be done to decorate the ends. It would be fun to take a little saw and a chisel and arch the top. On the next page are several designs showing how a skilled workman might do it. You do not put these on your working drawing. You make a separate sketch.

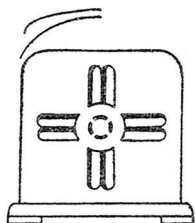
TAKING IT FROM A WORKING DRAWING



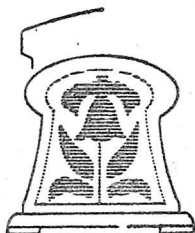
BRASS TACKS



PIERCED WITH AUGER
AND COMPASS SAW



GOUGE WORK

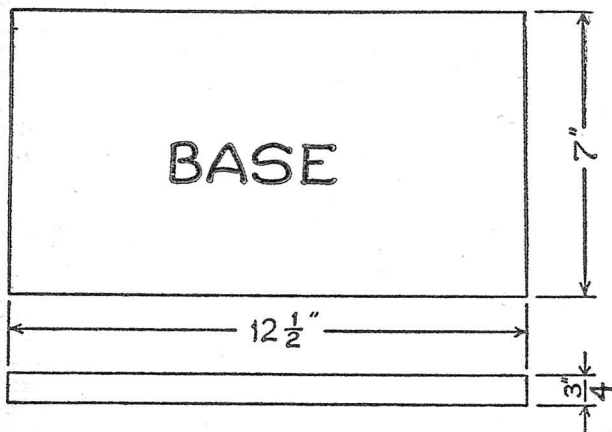


PAINTED

HOW TO WORK WITH TOOLS AND WOOD

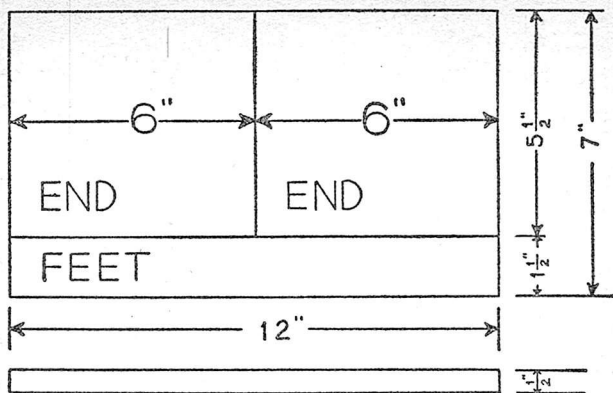
Having drawn this plan yourself it is perfectly obvious that you can work now from the plan to the wood. In other words you can now take it from the working drawing and you can do a better job than you could if you had taken it from your imagination.

There is one more part of a working drawing, however, which you may make for your own convenience, and that is the layout of stock. Your base is 6" x 12" long when finished. You must allow waste wood on each side of your piece. Therefore, you need a piece at least $12\frac{1}{2}$ " x 7" to allow for sawing and planing. You can buy lumber which is dressed on both sides and, therefore, you can figure your final thickness of the base when you purchase your piece of wood ($\frac{3}{4}$ "). The diagram below shows it exactly.



Now you wish to add the two ends and the feet. The two ends are $5\frac{1}{2}$ " x 5". Your feet are $1\frac{1}{4}$ " square and there must be four of them. You can lay them out like this, allowing waste at each side:

TAKING IT FROM A WORKING DRAWING



So there are the two boards which you need to make the bookrack. Any kind of wood will do, but it would be most fun to work with mahogany, walnut, oak, or any other good, clean, clear hard wood.

You are now ready to translate your diagram into wood. There it is all waiting for you. It must be planed, square, and to size—each and every piece, one piece at a time.

You are going to want to drive some brads through the feet into the base plate to hold them on. You must make the joints. But outside of that and the use of glue there is nothing difficult. It's just like all woodworking. After you've been at it a little while there are only interesting variations using the old motions. That is what makes it so fascinating. Every little thing you do increases your skill. Of course, the operations of finishing are new, too, and so it will be easiest if we go on still talking about the bookrack. We will make the joints, glue the parts together, and take a hand with the sandpaper, ending the job finally with a little shellac or varnish.

CHAPTER FIVE

Finishing Up the Project

BEFORE YOU ARE READY to tackle your joints you have, of course, finished the end pieces and the plate and you are ready to lay out the joint. There is a problem, the mortise itself (the hole or slot the tenon fits into).

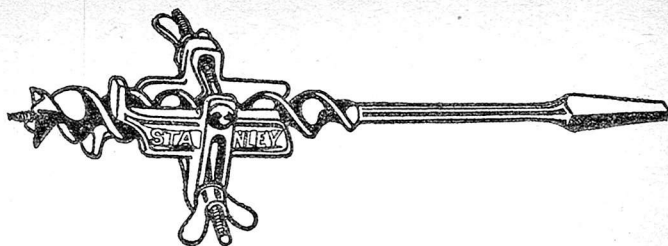
Holes should be bored for this mortise.

It must be done accurately and carefully. The way to proceed in laying out joints is to make your measurements with great accuracy and to mark the joints as illustrated with a knife line or a hard pencil well sharpened. Accurate work cannot be done with thick lines.

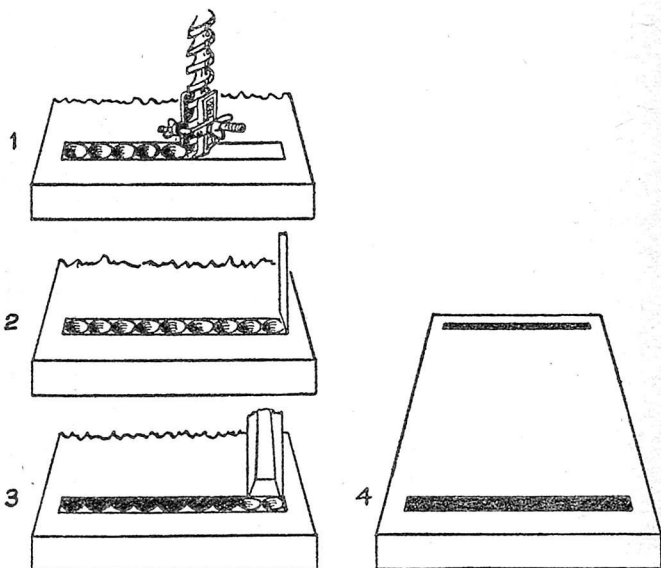
The first step in making this mortise is to bore holes, with an auger bit. These must be bored to a fixed, uniform depth. Some woodworkers regulate the depth of the holes by counting the turns of the bit brace, because the screw of an auger bit will pull the bit into the wood at a constant rate if it is held firmly against the wood. This method, however, is not very accurate. A simple contrivance is to bore a hole through a block of wood and then saw the block to the proper length, allowing the bit to protrude the right distance through the hole. The most convenient method is to use a bit gauge.

In cutting joints with the chisel, do not work exactly up to the lines until the final fitting. Make sure which side of the line is the waste side before cutting the wood. Surfaces in your finished joint should be in contact with each other

FINISHING UP THE PROJECT



Auger bit with bit gauge.



1. Remove waste wood with auger bit.
2. Cut ends with chisel and mallet.
3. Cut sides to line with the chisel.
4. Clean corners and bottom of mortise with chisel.

HOW TO WORK WITH TOOLS AND WOOD

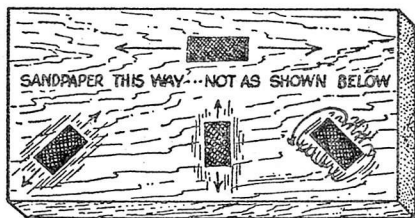
throughout their entire areas so as to make strong, sightly joints. With reasonable care in marking, boring and cutting, the joints should fit without further trimming.

The tenon should also be marked carefully. It is very easy to make. You merely make saw cuts at each corner. A chisel will dig out these corners very rapidly and it is simple to make them the proper size. The mortise itself will be a little bit difficult to make straight on the sides and square in the corners. It is just a question of patient paring with a chisel. Your joint will be much stronger if you do this carefully than if you let the sides or bottom corners remain rough.

You should have completed any decorating that you wish to do on the ends of the bookrack itself.

What is left is the sandpapering and putting the parts together so they will stay put.

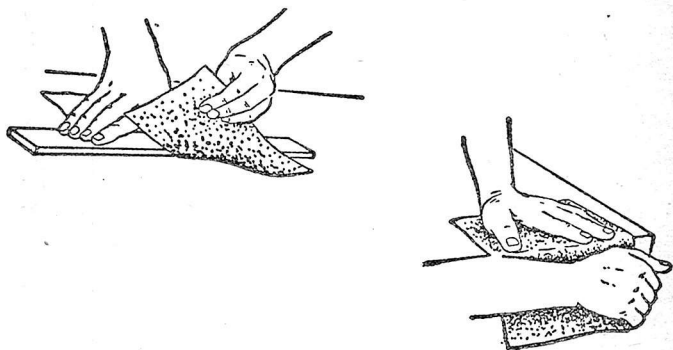
The astonishing thing is that even sandpapering has its little tricks. Not long ago I had a fine piece of molding completely spoiled by a workman who thought he knew how to sandpaper—who thought everybody in the world must know how to sandpaper. The same general principle applies to sandpaper as to any other cutting tool. It is easy to sandpaper with the grain. It is not only difficult but almost disastrous to your final finish if you sandpaper across the grain. This will tear and roughen the surface fibers, as shown in the diagram. If you are going to stain the piece your entire job can be spoiled by sanding across the grain. The torn fibers



FINISHING UP THE PROJECT

of the wood will absorb more of the staining fluid than the rest of the wood, causing dark, unsightly spots and lines.

The best sandpaper is made of tough prepared paper coated with glue on which are sprinkled particles of graded garnet, quartz, or flint. Garnet paper is the best. Sandpaper runs from very fine No. 6/0 to very coarse grades. A No. 1 would be coarse enough for your first sanding operations. The diagrams below show how to tear it.



How to tear sandpaper.

Another thing that must be watched very closely when you are putting on your fine finish is to avoid rounding corners. It is just as important to sand an edge square as it is to plane it square. That's why a square block of wood around which to wrap the sandpaper is important. (See diagrams, page 31.)

The pieces should be put together before you stain or finish them. The first step is to put on the feet.

These feet will have no stain upon them and so it is quite proper, according to the best methods, to nail them on to the plate with brads. Yet even such a simple operation has its inherent problems. Many a piece of fine finished oak has been completely ruined by a careless workman who drove too large a nail through it, splitting the piece as beautifully as though

HOW TO WORK WITH TOOLS AND WOOD

he had done it with an ax. With ordinary nails of fairly good size it is just as necessary to bore ahead of the nail with a hand drill, when using wood like oak, as it would be if you were going to put in a screw. Of course it must be a tiny hole, not more than two-thirds the size of the shank of the nail itself.

In this case it will insure that you do not split the feet. Even these little brads should be put in carefully and in the right place, not too near the edges and not driven in straight. They should be slanted (or "toed"). They then act as cleats or dovetails and will hold beautifully.

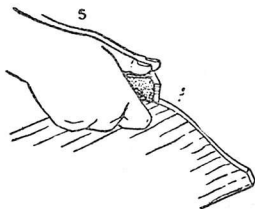
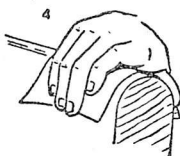
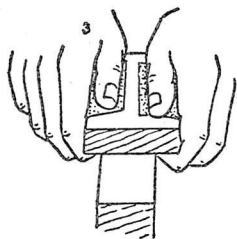
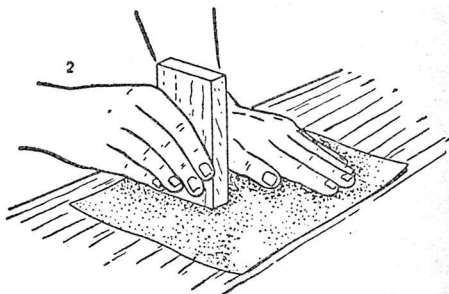
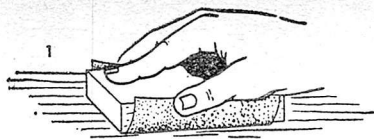
It is equally important that these feet be placed squarely on each corner so that they form an integral part of the finished design. (See the drawing on page 23.)

A much better job of putting on the feet will result if you not only nail them but also glue them. Of course, the gluing must be done before the nailing.

Glue is one of the cabinetmaker's secrets for producing good work. Good glue is so strong that when properly used it is frequently much stronger than the wood itself. Ordinary liquid glue is very convenient because it is always ready for use. But it is not as strong as hot glue. No professional cabinetmaker would think of using anything but glue which has to be "cooked." I confess, however, that in my home workshop I depend on liquid glue and have found it extremely satisfactory. Recently new casein and resin dry-powder glues have been made that can easily be prepared with cold water. They are most satisfactory and easy to use. Put a thorough thin coating of glue on the joints and then firmly fasten these joints together with good clamps. Wipe off any glue that shows before it sets and give the joint plenty of time to dry. (If you want to use hot glue, full information will be found in Chapter Nine.) After the glue has hardened (twenty-four hours should be allowed), it is very important to go over the piece of work again to remove any surplus exposed glue and to finish with fine sandpaper.

When the gluing is complete you have left only the stain-

FINISHING UP THE PROJECT



1. To sand a surface.
2. To sand the end of a small block.
3. Using a block to keep corners sharp.
4. To sand a rounded edge.
5. To sand a curved surface.

HOW TO WORK WITH TOOLS AND WOOD

ing and polishing, one of those little jobs, that, with a reasonable amount of care, you can accomplish very quickly with a good deal of fun. It is a modern idea to finish wood as naturally as possible. You have undoubtedly noticed that some furniture is advertised "natural wood finish." It does not mean, however, that you may leave the wood as it is when you have finished sandpapering.

A well executed piece of woodwork displaying the natural color and sheen of the wood, with its smoothly finished surfaces and tightly fitted joints, has a distinction and charm peculiarly its own.

To the eye of a good workman, an article lacks completion unless something has been done to preserve the beauty of the wood. The fine color of a freshly cut piece of wood soon fades, as the action of light, settling dust, and dirt from handling, gradually mar the natural beauty. Then again the absorption of moisture and subsequent drying out are detrimental to the wood and to the joints.

Bare wood when washed soon takes on a grayish parched look and the grain becomes rough and splintery. Many woods do not fully show their beautiful color and grain until they have undergone a process of finishing.

There may be many colors in one piece of work, due to the natural variations in the wood or to the use of different kinds of wood for the several parts. In such cases it may be desirable to equalize the different colors. Decide beforehand some arrangement for the colors which will make a pleasing distribution.

Finishing a piece of wood serves two purposes, its preservation and the enhancement of its beauty. All work should carry out both these ideas, but unfortunately in many cases preservation is favored to the exclusion of beauty.

The bookrack may be finished with shellac or varnish, procuring a bright finish. If a dull finish is wished, rub down the varnish or use linseed oil or wax. If you wish to stain the wood a commercial product may be used, preferably an oil stain because it is the easiest to handle. Apply the stain freely

FINISHING UP THE PROJECT

and quickly with a sponge, rag, or brush, working with the grain as usual and carefully avoiding any overlap. As the color begins to dry, rub off with a soft rag any surplus stain not absorbed by the wood. This prevents the grain becoming obscure or clouded. Cover the surface well but do not apply the stain too lavishly.

Shellac is easily applied with a brush and if either shellac or varnish is used it should be rubbed down when thoroughly dry with very fine sandpaper before a second coat is put on. After a coat of shellac has been applied to seal the pores of the wood ordinary floor wax may be used to produce a soft dull finish.

And now, with the bookrack either mentally or actually completed, you have gone through much more of your apprenticeship than you may realize. If you have not merely read and have actually gone ahead with the work described, you have certainly learned the rudiments of reading a working drawing and you have thought through every step of making an article which you had in mind.

If you have actually made the bookrack without a good workbench you will appreciate how much more fun it will be when you have a bench to work on.

CHAPTER SIX

This Will Be a Bench

NOW, roll up your sleeves and get' set for the most fun you've had in a long time. You are going to make your first piece of furniture—and an important piece it is.

Your workbench!

It's going to be a good one too! It should be, for it will be the scene of countless hours of fun and satisfaction for you and your family.

Naturally, you'll need a flat, solid surface on which to work—two or three kitchen chairs or the kitchen table or a couple of wooden boxes will do.

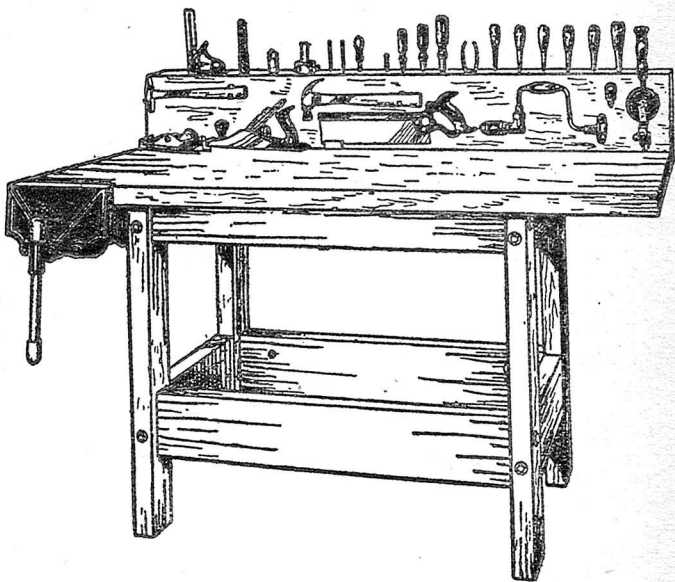
There is no fine work required to make a bench. If you make a few mistakes—and you won't have much fun unless you do—it won't seriously matter. What you are actually producing is a big strong table. Most important, there isn't any easier way to learn to use tools than to start right in on something that you really want.

Every person who follows through carefully from the beginning of the operation to the completion of the finished product will have learned all the basic things about using a saw and hammer, a plane and a chisel, as well as a brace and bit. He will have seen how a simple joint is made. He will have had the experience of going to his lumber dealer to get the materials, to the hardware store to get the hardware needed to complete the job, experience, adventure, instruc-

THIS WILL BE A BENCH

tion and accomplishment, all for the price of one sturdy bench.

As in every carpentry or cabinetmaking project, all there is to do is to cut materials into their proper lengths, widths and thicknesses, make the necessary joinings and put the whole group of pieces together. If you do these things, one at a time, and do each thing carefully, you will do a beautiful job.



A good bench for practical use, such as we are talking about is 5 feet long and stands 32 inches high. It has a vise and you can add to the top of it various little devices as you wish, such as a bench stop for surfacing boards and a bench hook for holding work which you are sawing or chiseling. As

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a matter of fact, this will be a bench fine enough for any woodworker. But at the moment of starting don't be burdened with the thought that you're making a piece of shop furniture. All one has to worry about in the beginning is getting some boards.

The first question, of course, is what wood must be bought from the mill or lumber dealer. Your working drawing will really pay off here—just like money in the bank. From it you can easily determine just how few boards it will take to do the job. Your bench will require only five or six pieces of wood. From these will come all sixteen or eighteen wooden parts.

The bench is going to get some hard wear. That means that you will require a certain amount of hard wood which will stand strain and rough usage. As you probably know, there are basically really just two kinds of wood—hard and soft. Hard wood takes a fine polish. Some of the hard woods are relatively soft, some of the soft woods are relatively hard. But any lumber dealer can tell you the right wood to use for various purposes. Certainly I never bothered to learn much more than the general classifications, although some of my friends who have the bug bad can discuss at length the difference between kinds of pine and when to use oak or maple or chestnut.

In the case of a bench we know what parts of it must be strong. Therefore, we use strong, tough wood. You might use oak, which is strong and very hard. But oak has a tendency to split. Mahogany is too expensive. What is best for a job like this is maple.

A botanist would tell you that oak is "ring porous." If you look at the end of an oak board you will see that the rings by which you can count the age of the wood are so porous you can actually drop water into them. This is what makes oak split so easily, despite its excellent strength and toughness. Maple, on the other hand, is "diffuse-porous." It has small pores of various sizes, but these are scattered irreg-

THIS WILL BE A BENCH

ularly through the rings of growth so that the piece of maple is much harder in actual use.

Almost any lumberyard can supply the maple you need for your bench, but if maple is not obtainable you can safely use almost any hard wood. Tell your lumber dealer what you want your wood for, so that, if he cannot supply you with maple, he may provide a good substitute, such as birch, beech or oak. Other woods would also serve, such as white pine, yellow pine, white wood, fir or spruce.

If you decide on one of these, try to get at least one piece of maple for the front board of the top, which is going to get the most hard wear.

What you want are good pieces of wood which are straight and well seasoned, and comparatively free from knots. Knots are the bane of the amateur workman. I never have been able to learn to saw, or plane, or chisel, a piece of knotty wood and if the wood is for use in a finished piece of work it presents the disadvantage of being more difficult to finish.

Of course you cannot buy wood which is absolutely clear unless you go to great trouble and expense. What the clever carpenters do is accept lumber which has a few firm knots in it, calculating to saw out their individual pieces so that any large knots do not come where they interfere with the nailing or joining work.

One of my friends when he first began to work with tools did a thing which seemed to me extremely ingenious. He went to his local lumberyard and got a small piece of every kind of wood they had. That made a bundle of twenty or thirty sticks. He got the lumberman to label each one for him and then he went home and tried them all, making a little memorandum for himself, which told about the various difficulties and the various points of advantage from his own experience. What he had to say about one of the soft woods—Georgia pine—was more profane than logical.

Georgia pine is cheap, usually, but it is full of resin. It is as hard as most hard woods and very difficult to saw, let alone

HOW TO WORK WITH TOOLS AND WOOD

to plane or chisel. Yellow pine (often known as long-leaf pine) is halfway between white pine and Georgia pine in this respect. It is very strong and serviceable for things like the legs of a bench.

Most of us who are interested in the shop are not particularly interested in the way these various woods grow. For, off-hand, it is enough to know that the soft woods, as we call them, are of the same general family of coniferous trees. The hard woods are from deciduous trees which lose their leaves in the winter time.

If you can do so, follow the procedure of my friend. Try the various woods which your lumber dealer carries, with your own tools.

Here is what the dealer should be asked for on the bench we are describing (but read this chapter through before you purchase this lumber).

Pieces	Thick	Wide	Long	Part
*1	2"	8"	12' D4S	Top
*1	2"	6"	12' D4S	Top
1	2"	4"	12' D4S	Legs
1	2"	4"	10' D4S	Top Rails
1	2"	6"	10' D4S	Bottom Rails
1	1"	12"	6' D4S	Tool Rack

*Any combination of pieces of varying widths may be used.

D4S means "dressed four sides." Thus, the 2" x 8" piece will measure approximately 1 $\frac{3}{4}$ " x 7 $\frac{1}{2}$ " when dressed. The sizes mentioned are stock sizes such as a lumber dealer would carry, with the exception of the board for the tool rack. In this case he might have a short length piece, or he might accommodate you by cutting a 12' piece in half. You may wonder about the lengths mentioned when comparing them with the finished sizes. Some waste should be anticipated because stock lumber almost always has the ends cut uneven and there are invariably some short splits or checks, as they are called.

THIS WILL BE A BENCH

When buying lumber, it is important to remember that it is measured and sold by the board foot (the amount of lumber in a piece 1" x 1' x 1'). However, when you buy lumber that has been milled down to less than 1" thick the lumber dealer charges you for a full inch. Because of milling, 1" lumber actually measures 25/32". Lumber which is 2" to 6" thick is actually 3/8" less than the named dimension. Planks 8" or more in thickness lose 1/2" when dressed.

The stock should be cut to the following sizes and the pieces marked with their proper name:

Pieces	Thick	Wide	Long	Part
*2	1¾"	7½"	5'	Top
*2	1¾"	5½"	5'	Top
4	1¾"	3¾"	30¼"	Legs
2	1¾"	3¾"	35½"	Top Front and Back Rails
2	1¾"	3¾"	16½"	Top End Rails
2	1¾"	5¾"	35½"	Bottom Front and Back Rails
2	1¾"	5¾"	16½"	Bottom End Rails
1	¾"	9½"	5'	Tool Rack
1	¾"	1¾"	5'	Tool Rack

* Any combination of pieces of varying widths may be used.

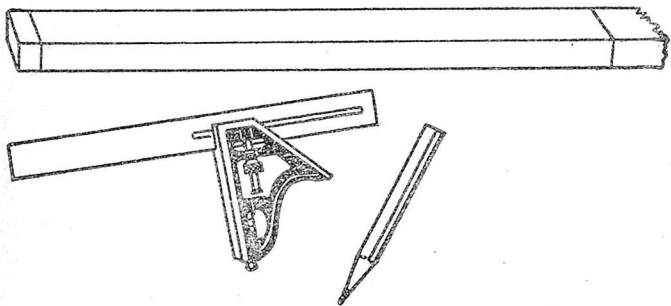
The little waste you will have will probably prove handy at a later date for some repair around the house or for one of your next projects.

You are now ready to start your cutting. Before you do so, however, I urge you to read not only through the rest of this chapter but through *the whole book*. In this way you will get clearly in mind the series of steps in making the bench and will learn some basic principles of the use of tools that will stand you in good stead as you perform all the necessary operations.

HOW TO WORK WITH TOOLS AND WOOD

Suppose you think first of cutting your four bench legs. You begin by carefully marking a line around four sides near one end, using a try square and a pencil. Next you measure off the length of the leg plus 1" and again square a line around the four sides. Do this for all four legs.

This is a sample of the way you always use a piece of material as it comes from the lumber dealer. You make as many pieces out of it as you possibly can but you always allow extra space for the finishing process. I remember that when I was first trying to handle tools I didn't know about



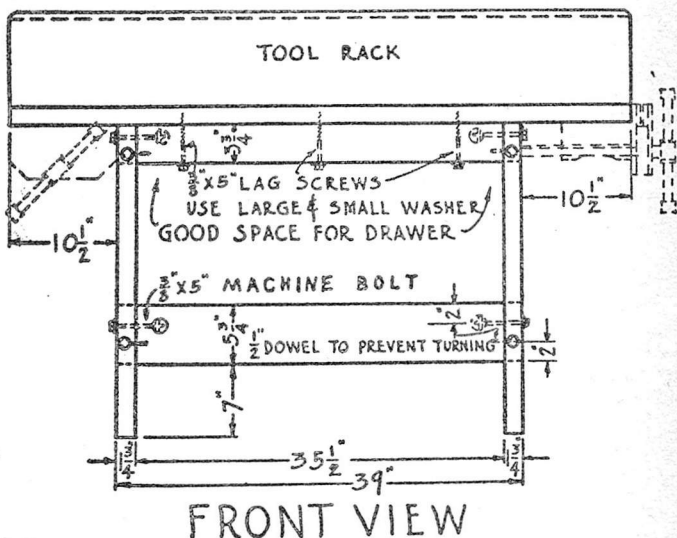
this necessary extra length and width. That meant that every mistake I made was irretrievable. I tried to cut each piece as though it were a finished piece. There really isn't anybody good enough to do that because we all occasionally make a mistake. Another way I got myself into trouble was that I did not mark each piece as I cut it out. I found myself with various sized sticks and boards when I got all through and I didn't know where half of them went. It was like putting together a watch and having a couple of wheels left over.

Mark your plan with numbers, or write on each piece of wood as you saw it out exactly what it is for. But don't try to carry each piece's purpose in your head. No head is that

THIS WILL BE A BENCH

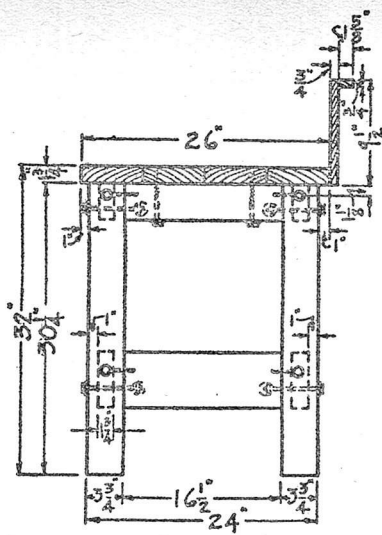
good. You won't have any fun. Somebody will call you to the telephone or send you down to the grocery store to get some butter and when you come back you may have forgotten whether you were cutting out a leg or a rail.

Now you begin cutting off the legs with your crosscut saw. Be sure to stay on the waste side of the line. If the cut is not perfectly true, and it probably won't be even though an experienced woodworker is cutting it, you can plane off the end down to the pencil line. You can test it with your try square. If in sawing or in planing you have gone below the

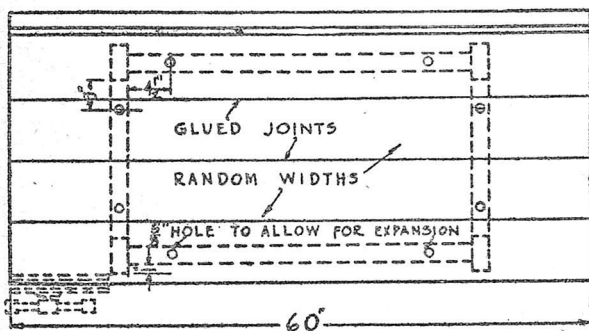


This is the front view of our working drawing.

HOW TO WORK WITH TOOLS AND WOOD

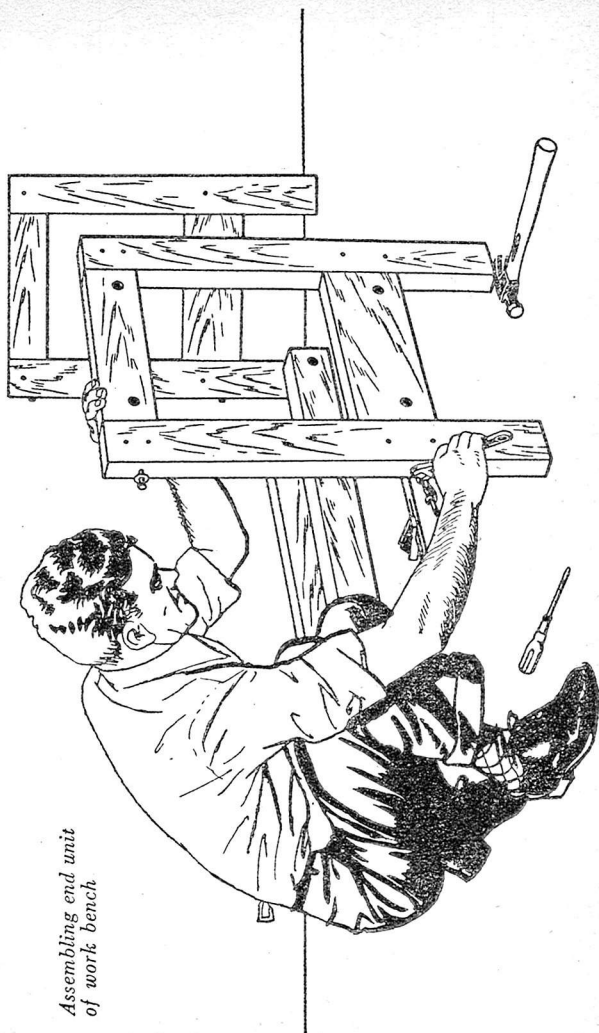


SIDE VIEW



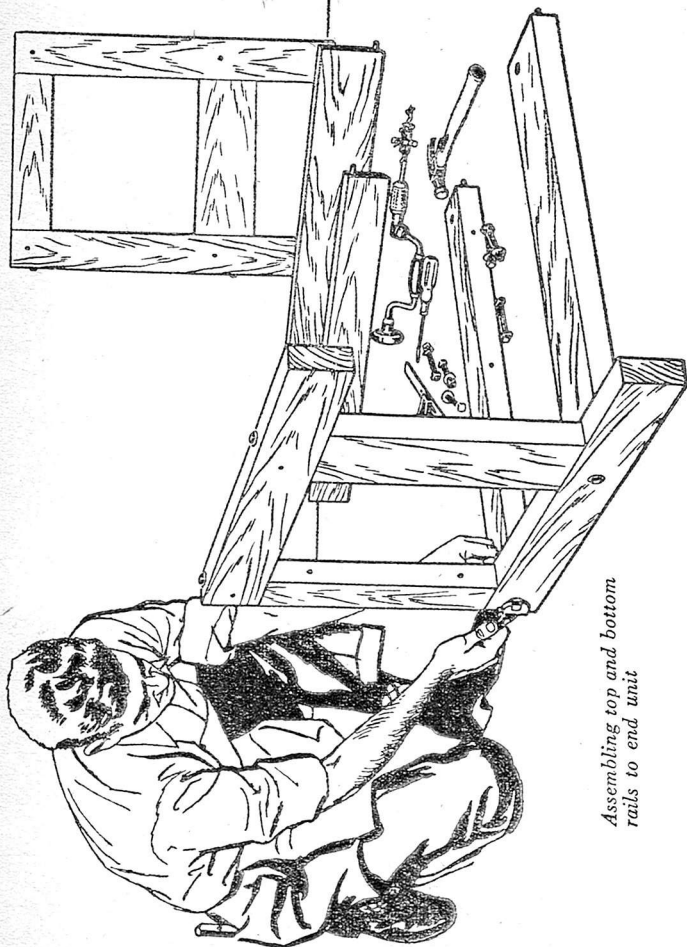
TOP VIEW

THIS WILL BE A BENCH

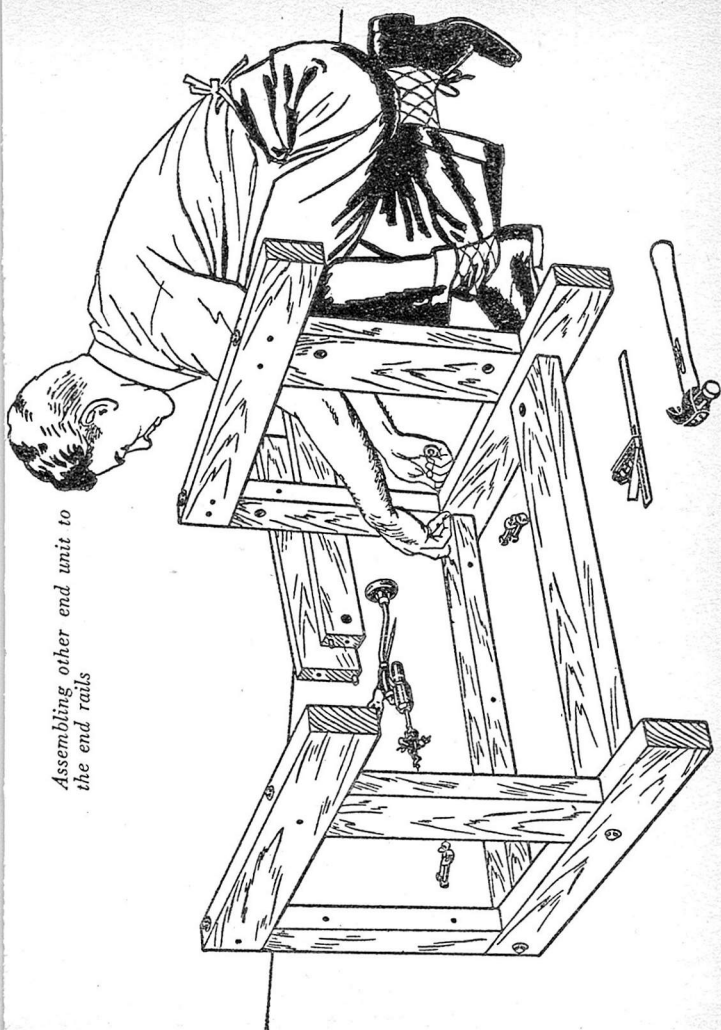


*Assembling end unit
of work bench*

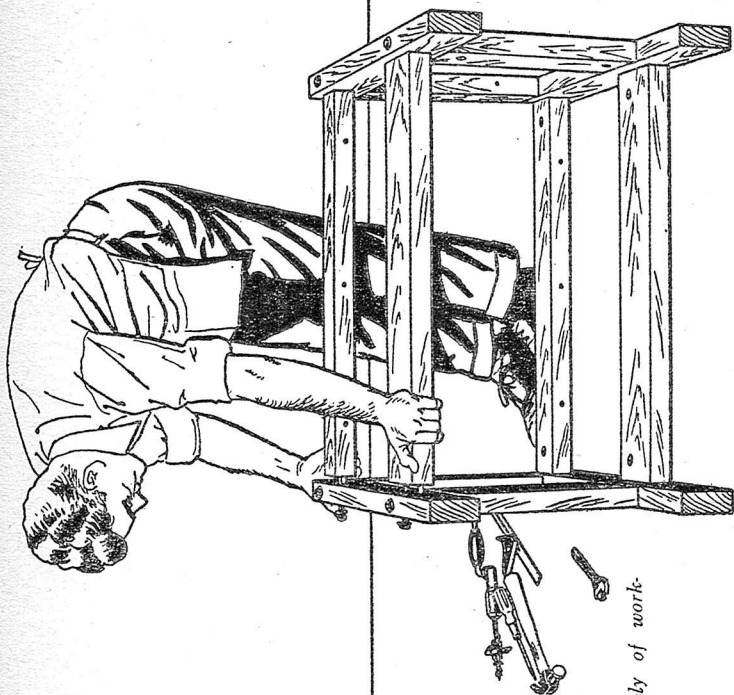
HOW TO WORK WITH TOOLS AND WOOD



Assembling top and bottom rails to end unit



Assembling other end unit to the end rails



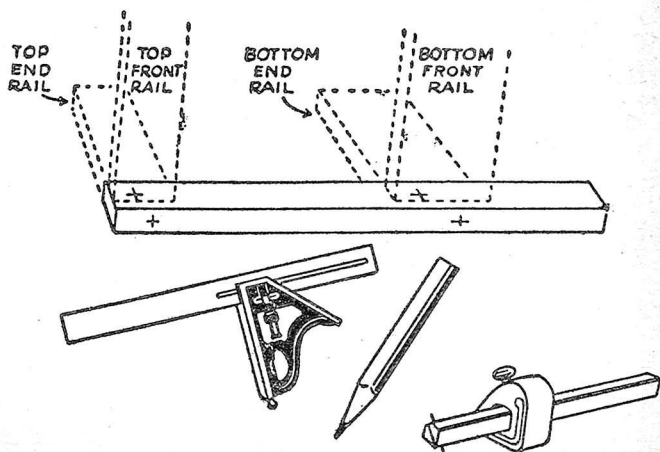
*Complete assembly of work-
bench frame*

THIS WILL BE A BENCH

line, the extra inch on the other end has saved you from cutting it too short. When you are satisfied with the trueness of one end you can then square a line for the finished length on four sides and proceed with sawing it to an accurate finished length. Remember to saw on the waste side of the line. On this second end you have no reserve to fall back on so more care must be taken not to cut below your finished line. Test frequently with your try square when planing. A good mitre box of course makes short work of cutting such pieces square.

This procedure is the same for cutting all the members of the bench frame.

All pieces that are duplicates should be tested by placing one piece on top of the other to see that they match perfectly. Special care should be given all ends of the rails, to see that they are perfectly square and true, as this bench is assembled with butt joints.



HOW TO WORK WITH TOOLS AND WOOD

You will also need sixteen $3/8''$ x $6''$ long machine bolts and ten lag screws of $3/8''$ x $5''$. The former hold the rails to the legs, while the latter fasten the top to the underframing. Note these in the plan (see page 41). Use a $7/16''$ auger bit for all the machine bolts and $5/8''$ for the lag screws. This enlarged hole permits for some expansion and contraction of the top.

Locate the two edge and two side bolt holes on the four legs. Lay them out carefully with the aid of your try square and the marking gauge. Extra squared lines to determine the position of top and bottom rails will be of considerable help.

Lay all four legs alongside each other to check their ac-



Bolt holes bored in leg.

curacy. Then follow by boring the holes through the legs.

The next step is to locate the centers for the bolt holes in the bottom and top rails. Give each butt joint a number. For example, the joint for the front top rail would be number one. Mark number one on the leg and the top rail near the joint. Then proceed to give every other joint a number—two, three, etc., through to number sixteen.

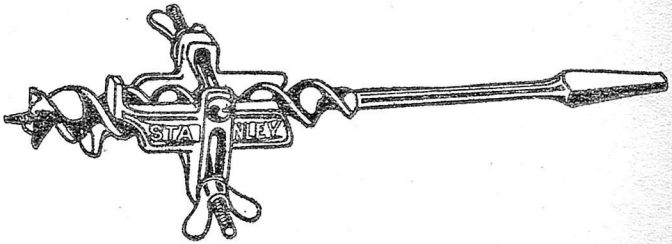
After this operation you can hold the leg at joint number one in its proper position to the front top rail. The hole that has been bored through the leg will give you the center for boring the hole in the rail. Merely insert the auger bit through the hole of the leg and with a couple of turns you have a small hole made by the screw of the bit that determines the center of this hole.

By following this procedure for each joint, holes will be located properly even though the hole bored through the leg may be slightly out of line.

THIS WILL BE A BENCH

With all these centers determined on the ends of the rails you can proceed to bore these holes.

In the rails all the holes for the bolts should be as deep as the bolts, less the thickness, $1\frac{1}{2}$ ", of the leg for front and back rails and less $3\frac{3}{4}$ " for the width of the leg for the end rails. Use the bit gauge to control the depth of holes.



Bit gauge.

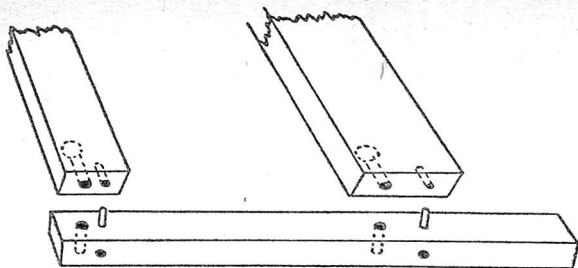
Following these boring operations, lay out the centers on the inside faces of the rails for boring a 1" hole for the nuts. The bit gauge is again used for boring a 1" diameter hole for the nuts of the machine bolts. Remember that the holes for the machine bolts in the end rails are not as deep as they are in the front rails. Put a bolt through one of the holes in a leg and determine in this manner where the hole should be for the bolt nut.

The bit gauge is again used on the 1" bit because you will only bore part way through.

Centers can then be located for the $\frac{5}{8}$ " holes (to allow for expansion) in the top rails for the lag screws to fasten the top to the frame and the holes bored.

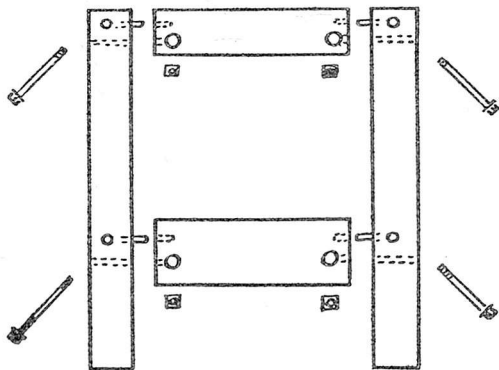
Short dowels $\frac{3}{8}$ " or $\frac{1}{2}$ " in diameter and $1\frac{1}{2}$ " or 2" long should be provided in addition to bolts between all the rails and legs, to keep the rails from turning. Your hardware dealer sells dowels in 36" lengths and all you need to do is to cut them off to the length desired. Lay out the centers for these dowel holes carefully and bore the holes to the desired depth, about $\frac{1}{16}$ " deeper than half the length of the dowel.

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After this is completed the entire bench frame is ready for assembly.

Place all four pieces for one end in position on the floor. Put the dowels in place, put a washer on each bolt and pass it into its hole.



Place a nut through the nut hole and turn the bolt until the leg and the rail are drawn tightly together. When all bolts are in place, assemble the other end unit in the same manner.

THIS WILL BE A BENCH

Place these end units on their edges on the floor with the top and bottom back rails in place between them and assemble the balance of the frame. Go over the entire assembly with a try square or steel square and test it for right angles.

You now come to the preparation of the bench top. This is where you will have some experience in planing the edges of the top straight and true. Lay out the pieces the way you want them, determining also the top or best side. Number these pieces and then start your planing to get them true and straight so they will fit perfectly together. For this job the longest plane is, of course, the best. The skilled carpenter or cabinetmaker would use his jointer plane or fore plane for this work. These planes are 18", 22", or 24" in length and therefore their long bottom surfaces produce a true surface easier. Nevertheless it can be accomplished with a little more patience and time with a jack plane. Plane a little and test frequently with your square. If you have a full size carpenters' square with a 24" blade this would serve as a good testing tool for straightness. The bottom of the plane tilted on its corner is, of course, a common means of getting a quick test for trueness also.

After all the edges are true and matched to each other they are ready for gluing. If desired, holes may be bored for dowels (see doweling jig, page 114). Dowels would improve such a top and would keep the pieces aligned perfectly.

The gluing job is accomplished with clamps but can also be performed by wedging on some old boards or planks.

Apply glue and clamp firmly together. Remove excess glue before it hardens. Let work set overnight and then remove clamps, and scrape off any remaining glue.

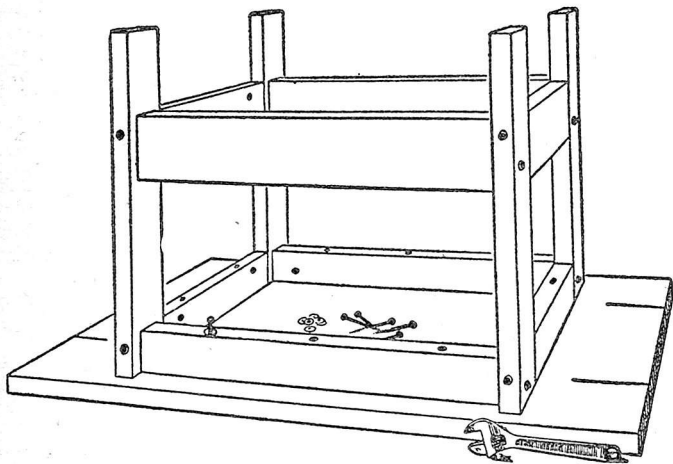
The top should now be planed, scraped and sanded to a good, smooth surface for your fine work bench. It is ready for assembling to the frame. Use the 5/8" auger bit again to locate the centers of the holes through the top rails, marking the underside of the top. You can then move the frame of the bench and bore holes in the top for the lag screws. Try boring a 1/4" hole into a piece of scrap wood and turn the

HOW TO WORK WITH TOOLS AND WOOD

lag screw into it. If you want a stronger drive, perhaps a 3/16" hole may be better, depending on the wood that you are using. Do not bore through the top. Set your bit gauge for the depth of hole desired.

Place bench top flat on the floor with the underframing in proper position on it, as shown below. Turn the ten lag screws with washers through the rails into the top and drive them tight.

Turn the bench up on its legs and inspect your work. See that all joints are tight, all sharp edges removed, and give it a general cleaning up.



The tool panel or rack is a suggested method of placing the most frequently used tools in a handy working position. You may prefer, because of necessity, to keep your tools covered or locked up in a tool chest or cabinet. You should in any

THIS WILL BE A BENCH

case have a definite place for each tool, and plan to keep each tool when not used in its place.

Good tools, when so cared for, and occasionally coated with a little oil to keep them from rusting, will last a lifetime.

If the tool panel is your choice you will want to proceed with the two pieces to make this rack.

The narrow top one must be prepared to hold chisels, try squares, screwdrivers, etc. This rack will not hold all the tools recommended. You should decide which you want to place in this handy rack. The picture (page 35) will give you some suggestions. Lay out the various holes and slots required for your tools along this piece, and then bore, chisel, and saw these out. Finish all edges smooth with sandpaper.

The narrow strip is then fastened along the top and at the back of the 9½" wide piece with glue and screws. Use five 2¼" x No. 10 flathead wood screws at practical intervals. Drill the screw holes through the narrow strip and countersink them for the flathead screws. Apply glue and assemble.

Locate a screw hole 3" from each end and three more at regular intervals along the base at the back of the panel 7/8" up from its bottom edge. Drill the screw holes and countersink them for flathead 1½" No. 12 wood screws. Place the panel in position against the back edge of the bench top and turn the screws through the panel into the bench edge.

Go over the panel with sandpaper, remove all excess glue, and round the upper end corners of the panel, as shown in the plan. This completes the construction of the bench.

Any type of continuous screw or quick acting vise can be used on this bench, like the one shown in the picture of the finished bench (see page 35). A retractable dog in the front jaw is a worth-while addition. A vise can be bought with or without it.

An ideal arrangement is to include not only a front vise but another on the right end, although this is not necessary. If you do install an end vise it should have a dog in the front jaw. The value of such a vise is for holding short boards secure and flat on the bench which at times is a very useful

HOW TO WORK WITH TOOLS AND WOOD

feature. This is accomplished with a bench stop. Boards are clamped between the dog of the end vise and the bench stop located in one of the 5/8" holes that should be made for it. These holes should be in line with the dog of this end vise.

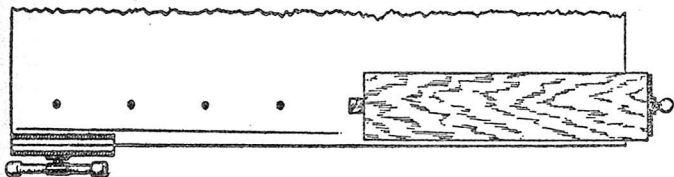
If your front vise has a dog also, one hole should be directly opposite the dog and in line with the others.

A 5/8" hole for the bench stop should be bored near the left front end of the top.

The bench stop in this position is of value as a means of holding a piece of wood for many brief planing jobs as it provides a stop against which a person can hold a board.

The bench stop can be removed from the hole when not in use.

The illustration below shows the arrangement of holes for the bench stop when the bench has a front as well as an end vise. It also shows how a board can be clamped in place between the bench stop and the dog in the end vise.



If the expense of this type of vise for the front of your bench seems like a burden you can manage by purchasing a low-priced woodworking vise like the one shown on page 13. This will hold boards horizontally and vertically and serve as a good auxiliary vise on a saw horse, etc., if at a later date you install a bench vise as shown.

While the plan does not specify drawers, in an effort to simplify construction for the amateur, one or more may be added under the top. The entire bench can be given two preserving coats of varnish or shellac. The end grain should be well filled to prevent checking or cracking.

CHAPTER SEVEN

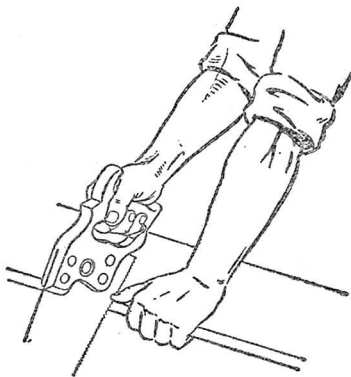
And Now About Using Tools

A PERSON with imagination, or one who has had a little experience with a saw and a plane and who has used these tools carefully and accurately, should be able to make the bench easily. But even such a person may not have picked up various little details which are easy enough to learn. So without going into the complete detail of every single operation, but handling the whole thing in a simplified way, I can tell you a good many things I have picked up from my own experience and from skilled craftsmen, which will save a great deal of time and irritation.

Take the detail of sawing one of these boards in two or sawing the end off with a crosscut saw. You might think that anybody can take the saw and saw on a straight line but it's not true. When I first began I spent a good deal of time trying to saw in a reasonably straight line and succeeding chiefly in cutting a fine gouge in my thumb. I did not know that in order to start my line there was, and is, only one way to do it. Grasp the handle of the saw firmly with the right hand, with the thumb and the index finger touching the side of the handle. Now draw the saw up at least one and probably several times with the thumb of the left hand guiding the blade on the wood where the cut is to be made. It should be drawn up slowly and carefully at exactly the point you wish the cut to begin. If you try to do it quickly

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the saw will jump and present you with a healthy cut thumb rather than a healthy cut board. Even that is not so bad as it is if you try to start the cut by pushing down on the saw instead of pulling up because before you may push down you must have the little guiding cut in the edge of the board. It is this down stroke which does the actual cutting when you are going full blast.



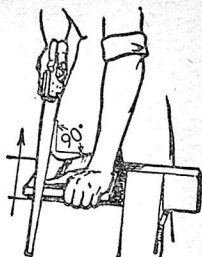
Guide the saw with the thumb. Draw the saw back to start it.

Another thing. A saw has thickness of its own. Therefore you do not start in the middle of the line. You have to start on the outside of it. What you wish to do is to saw roughly near this line, leaving the line on the board to be cut to exactly with the plane when you are doing the finishing that follows the rough cutting.

You should take hold of the saw very firmly after you have established the preliminary cut by pulling it up two or three times. If you hold it loosely it is very difficult to saw on a straight line and your arm becomes tired very quickly. As you push down the saw bites in beautifully and if you are

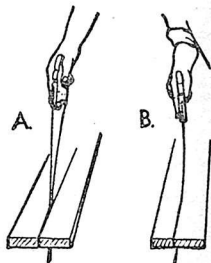
AND NOW ABOUT USING TOOLS

Start the saw cut by drawing the saw backward. Hold the blade square to the stock. Steady it at the line with the thumb.

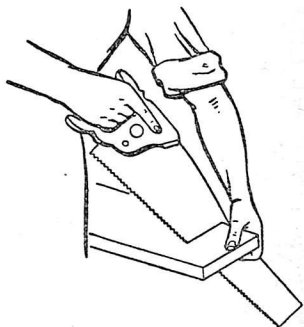


A. If the saw leaves the line, twist the handle slightly and draw it back to the line.

B. If the saw is not square to the stock, bend it a little and gradually straighten it. Be careful not to put a permanent bend or kink in the blade.



Hold the end of the board when crosscutting.

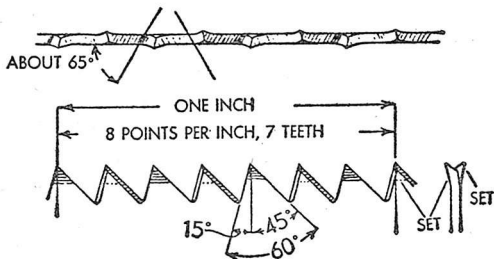


HOW TO WORK WITH TOOLS AND WOOD

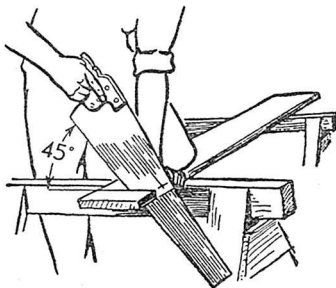
holding it firmly and giving a little pressure to the blade, making a firm, fairly rapid movement, your cut will start easily and nicely. The blade itself must be vertical or at right angles to the board to make a square cut. You can easily catch on to this if at first you carefully sight above and to one side as soon as your cut is started or test with a try square.

A long, slow, easy stroke is best, using the saw from the tip to the hilt, putting pressure only on the down stroke, with the board held firmly. The saw itself should be held at an

Crosscut teeth are like knife points. They cut like two rows of knife points and crumble out the wood between the cuts.



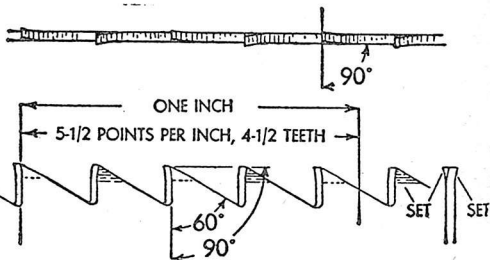
About 45° is the correct angle between the saw and the work for crosscut sawing.



AND NOW ABOUT USING TOOLS

angle of about forty-five degrees with the surface of the board for the most efficient cutting. The teeth don't have a chance to do their real work unless you hold the blade at approximately this angle.

If you are sawing a long board stretched between a couple of kitchen chairs, in making your bench, you've got to hold up the weight of the board with your left hand as you approach the end of the cut. If you don't, the saw will bind and be impossible to push through as you approach the finish of your cut. The weight of the board closes the saw cut on the



Ripsaw teeth are shaped like chisels. They cut like a gang of chisels in a row.

About 60° is the correct angle between the saw and the work for ripsawing.



HOW TO WORK WITH TOOLS AND WOOD

saw. Moreover, if you do not hold it up a piece of wood will break off before the saw finishes the cut and leave you a piece of broken wood, that you will have to glue back in place.

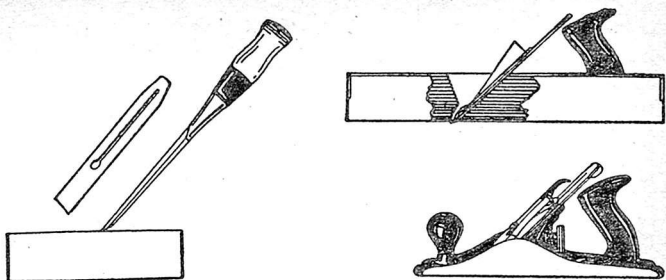
Of course, it is not good practice to cut with the grain with a crosscut saw. The rip saw works much more rapidly in that case. Let me emphasize again that nobody can have any fun with wood until he understands how to use tools in relation to the grain. The first thing which any good worker with wood does before he touches a tool to the piece is to examine the grain. He does it so automatically that if you asked him if he had looked which way the grain runs he probably would say no. But rest assured he has looked.

Practically everything that grows has a grain. You will find it in beefsteak, in leather, in a grain of wheat, or in a piece of wood. It is always more difficult to cut and smooth across the grain than it is with the grain. You can whittle smoothly with a pocketknife if you go with the grain. Go against it and the knife stops and you have made a deep angular cut when you merely wanted to cut a shaving.

A crosscut saw is made to cut across the grain. Its teeth are small and are filed to a point. They literally score two knifelike lines and grind the wood between into granules. The rip saw, on the other hand, cuts through more as a chisel does. The teeth of both saws are alternately bent or set, one to the left and one to the right, which insures a "kerf" or cut wide enough to keep the saw from binding.

Almost everyone will tell you that using the plane is probably the most fun in woodworking. A plane is nothing more or less than a chisel set in a block of wood or metal so that you can use both hands and work much more rapidly, taking off at each stroke a very thin shaving. This is the time when you begin to feel the real joy of carpentry—the smell of the wood rises in your nostrils, beautiful curling shavings rise from the blade, the surface behind the plane (provided you are planing with the grain as you should be) is smooth and slick.

AND NOW ABOUT USING TOOLS



A plane is a chisel blade with a guide to regulate the cut. Iron and wooden planes are fundamentally similar. Improved material, shape and adjustments make iron plane preferable.

Before adjusting the plane, first inspect the blade. By removing the lever cap you will notice that the blade can be readily removed from the plane. The blade has a cap iron screwed to it which should rest slightly back from the cutting edge on the unbeveled side. The cap iron acts as a shaving deflector. The sharp edge of the cap iron and the small flat surface that bears next to the cutter should lie tight along the entire width of the blade when they are screwed together. This prevents shavings from working between them.

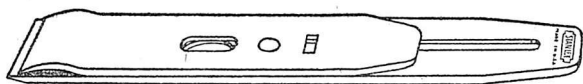
In putting the blade back in the plane, be sure to have the cap iron uppermost and on the unbeveled side of the blade and the cap iron uppermost in the plane. Replace the lever cap locking it with the small cam at the top.

You will now want to adjust your plane for planing a working face, if you do not have a good milled surface, or for planing an edge square to the working face.

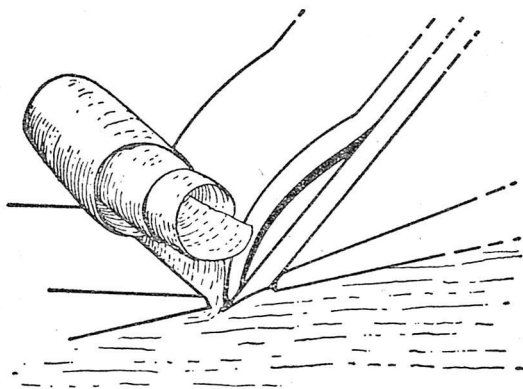
Hold the plane by the knob at the front end, bottom side up, in the left hand with the bottom or sole level with the eye. With the right hand move the adjusting lever to the right or left until both corners of the blade project equally from the throat. Then turn the adjusting nut until the blade slightly

HOW TO WORK WITH TOOLS AND WOOD

projects through the throat and above the bottom of the plane. This may be determined by touching the sole across the throat lightly with the fingers. A common mistake is to set the blade too far out. Take off very thin shavings, not thicker on one edge than on the other, and you will obtain better results without gouging the work or clogging the throat of the plane with the thick shavings.



Set the cap iron of the double blade near the cutting edge for hard wood—farther back for soft wood—or about $\frac{1}{16}$ " or the thickness of a dime.



The combined action of the cap iron and the toe of the plane in pressing down the wood bends the shaving and prevents the wood from splitting ahead of the cutting edge.

AND NOW ABOUT USING TOOLS

When beginning to plane, take a firm position in front of your bench or table with the left foot forward.

Carefully proceed to get a smooth square edge, testing frequently for straightness by sighting its length and for squareness with the try square.

Planing the working face smooth and flat is easy, and making the edge square is no more difficult. It requires nothing more than a little practice. If your hands are skillful enough to hold the plane square to the working face you will go through the operation rapidly.

On the following pages you will see the successive steps

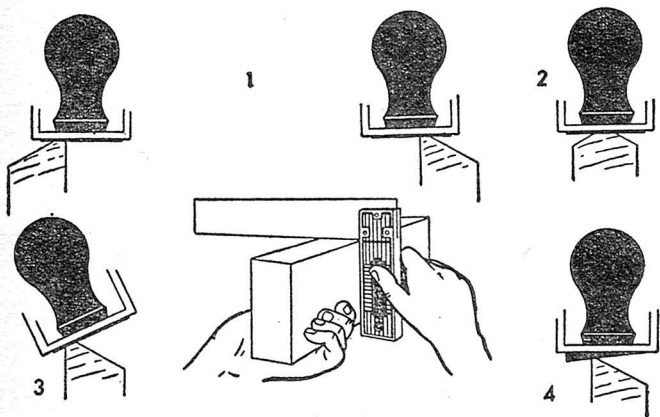


Sight along the bottom of the plane. Let the blade project a hair's breadth and set the corners evenly.

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in squaring a piece of wood. These operations are fundamental. Follow them carefully, unhurried, and test your skill. Practice planing on a piece of scrap wood. Almost anything is easy in woodwork after you accomplish these basic fundamental operations. In all operations with the try square, hold the try square tight against the stock when testing ends and edges, or scribing lines.

Outside of having your cutter sharp and set to take a fairly fine shaving and holding the tool as square as you can while you work, there is really little to think about when it comes to planing except that at the beginning of any stroke you put a little more pressure on the knob of the plane with your left hand than you do on your right hand. In the middle of the stroke the pressure is equal. At the end of the stroke you apply pressure with your right hand and practically no pres-

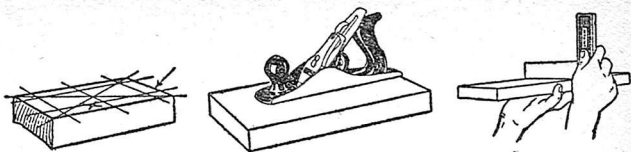


Hold the plane level when planing a square edge.

- 1. Hold like this when the wood is high on the right or left.*
- 2. Hold like this when the wood is high in the middle.*
- 3. Do not tip the plane this way.*
- 4. Do not set one corner of the blade farther out than the other.*

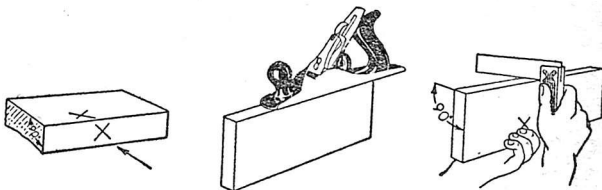
AND NOW ABOUT USING TOOLS

1. WORK FACE



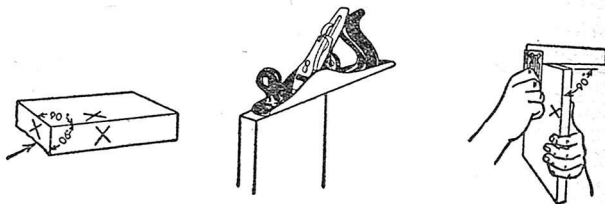
Plane one broad surface smooth and straight. Test it cross-wise, lengthwise, and from corner to corner. Mark the Work Face X.

2. WORK EDGE

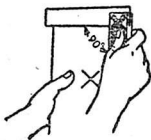


Plane one edge smooth, straight and square to the work face. Test it from the work face. Mark the Work Edge X.

3. WORK END



Plane one end smooth and square. Test it from the work face and work edge. Mark the Work End X.



HOW TO WORK WITH TOOLS AND WOOD

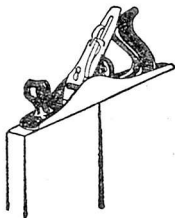
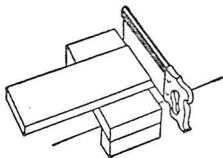
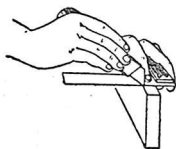
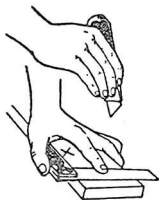
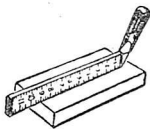
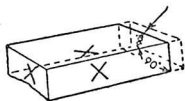
sure with your left. (These directions are for a right-handed user.) Thus you make a cut of approximately the same thickness from the beginning to the end and insure the straightness of the edge to the very ends.

If the wood has an irregular grain it may be necessary to plane one end of the board in one direction, and the other end in the opposite direction, but ordinarily, and particularly in a fairly rough job like the bench, this won't bother you.

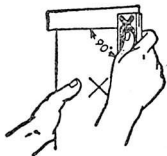
The first cutting on a long surface really requires a jack plane, which is ordinarily 14 inches long.

Its long bottom surface, called the sole, rides over the low

4. SECOND END

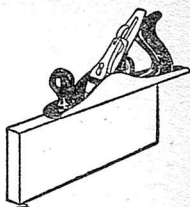
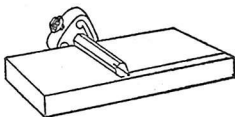
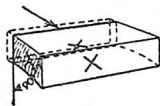


Measure length and scribe, around the stock, a line square to the work edge and work face. Saw off excess stock near the line and plane smooth to the scribed line. Test the second end from both the work face and the work edge.

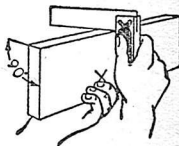


AND NOW ABOUT USING TOOLS

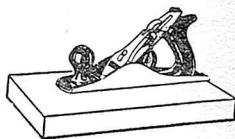
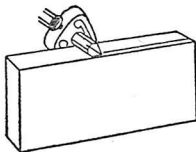
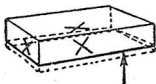
5. SECOND EDGE



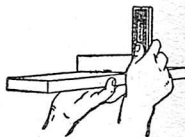
From the work edge gauge a line for width on both faces. Plane smooth, straight, square and to the gauge line. Test the second edge from the work face.



6. SECOND FACE



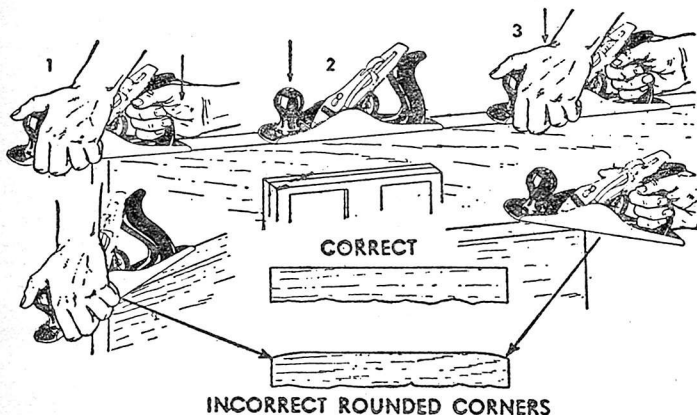
From the work face gauge a line for thickness around the stock. Plane the stock to the gauge line. Test the second face as the work face is tested.



HOW TO WORK WITH TOOLS AND WOOD

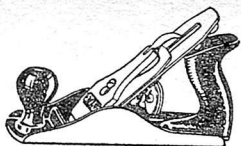
places and enables you to take off the high places, preserving the general plane of the surface.

The finishing is usually done with a smoothing plane which has a shorter sole. For many workmen who are puttering around the house the so-called Junior Jack Plane which is 11½ inches long serves both purposes adequately. For cutting across the end grain and smoothing up the ends of any piece of wood a small block plane about 6 inches long is the proper tool. The cutter of a block plane is set at a low angle and consequently cuts the end grain more easily. The first time I tried to use one I knocked off a quarter or half an inch at the end of my stroke, spoiling the piece of wood upon which I was working. This was because working across the grain in this fashion, even with a little block plane, is not far different from actually splitting the piece of wood when you cut over to the far corner.



1. Down pressure on the handle at the end of the stroke.
2. Pressure on both knob and handle.
3. Down pressure on knob at start to keep plane straight.

AND NOW ABOUT USING TOOLS



Smoothing Plane, 5½"-10" long



Junior Jack Plane, 11½" long



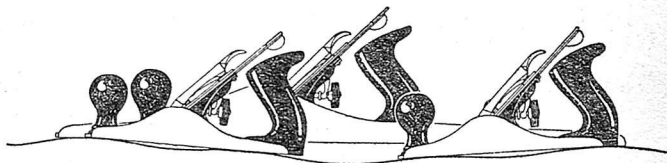
Jack Plane, 14"-15" long



Fore Plane, 18" long



*Jointer
22"-24"
long*

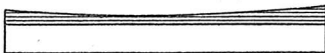
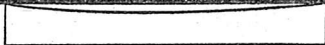


A short plane follows the shape of the wood as a small boat rides over the waves and into the hollows between.

A longer plane does not follow the hollows.

The procedure is to clamp a piece of wood on the edge of the board which is at the end of your block plane stroke, or, better, plane from the edges to the middle, not making a through stroke. (See illustrations on page 71.) Sometimes it is necessary to turn the wood in the vise several times rather than to approach the side of the board away from you. Saw

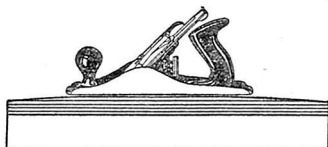
HOW TO WORK WITH TOOLS AND WOOD



TEST WITH A STRAIGHT EDGE



BEGIN PLANING THE HIGHEST SPOT



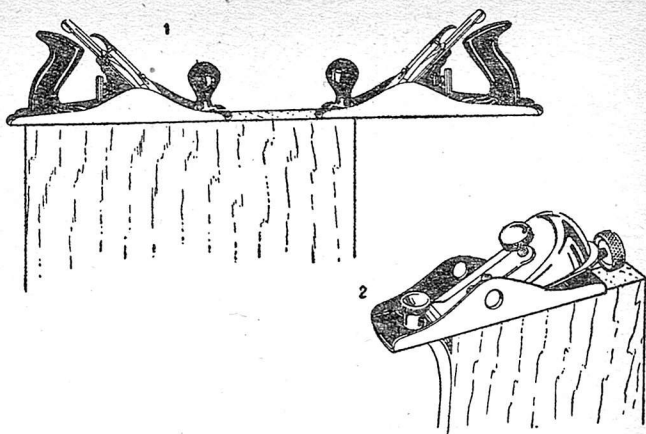
THEN PLANE PARALLEL TO DESIRED SHAPE
GRADUALLY LENGTHENING THE STROKE

as close as you dare to your mark, leaving only the finishing to be done at the end with the block plane.

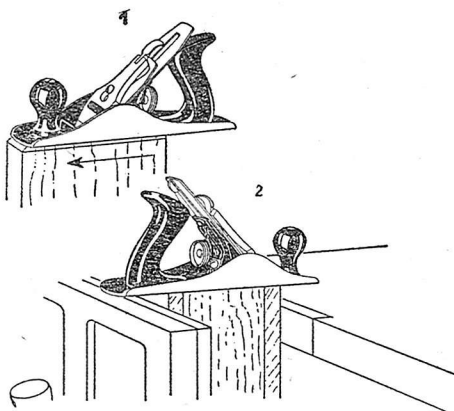
Anything which is to be really good and strong must be put together strongly. One way of achieving this is to use binding joints or bolts and screws. Another is to use glue and wooden fasteners. There isn't anything mysterious about glue. It is easier sometimes to use metal hardware. You can more quickly and easily get a strong joint with a bolt and screw properly set than you can with a mortise and tenon, or any other joints that cabinetmakers always utilize. So I feel the way to put your bench together is with bolts and screws, utilizing the simplest possible kind of joints, joints which will be strong, even though your hands are not as skilled as they soon will be.

Somehow, there is a satisfaction in tightening up a good strong bolt, pulling together two pieces of wood so that they will stay no matter how much you punish the piece of furni-

AND NOW ABOUT USING TOOLS



1. Avoid breaking corners on end grain by planing from the corner to the middle.
2. Do not plane from the middle to the corner.



- Methods of planing ends without breaking corners.*
1. Corner cut off relieves pressure on last fibers.
 2. Hold tight against work in the vise

HOW TO WORK WITH TOOLS AND WOOD

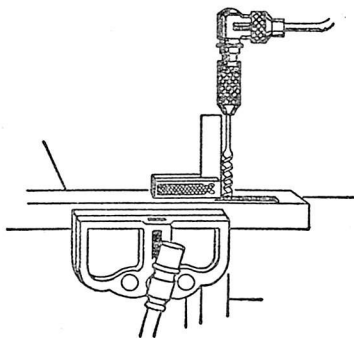
ture you are making. A work bench put together with bolts is just as workmanlike as one put together with the most elaborate joints that woodworkers have been able to think of.

In order to put a bench together you need to use only two or three more tools than those which have already been put into service. You will need a brace and bit with which to bore holes, a chisel with which to finish up your tool rack, a screwdriver, and a wrench. This means that there isn't much left to be done. With the various pieces cut to fit I easily finished the job in ten hours, although that includes no finishing touches, such as sandpapering.

For the job of boring holes we have that marvelous piece of machinery known as the brace and bit.

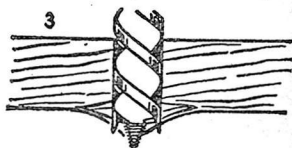
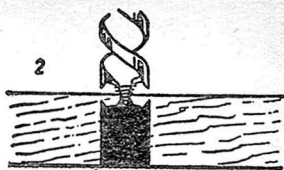
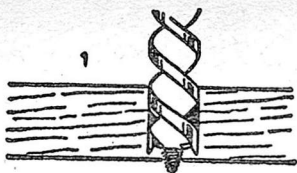
Holes are often bored crooked because the user of the auger just doesn't know how simple it is to bore them straight. That's all there is to it. The only problems involved in boring a hole are to get it straight and not to break through the wood on the bottom of the hole.

To bore straight you have only to sight on the piece of wood twice more after your hole is fairly well started in the



Test with a try square or learn to judge by eye.

AND NOW ABOUT USING TOOLS



1. Bore until spur appears on the other side.
2. Turn the wood over and finish.
3. Boring through from one side splits the wood.



Twist drills for wood are used to make holes for screws, nails or bolts. They are sized by 32nds of an inch and range from No. 2- $\frac{1}{16}$ " up.

Bit stock drills are designed and tempered to make holes in metal, but may also be used in wood, especially in repair work where contact with nails or metal is possible. They are sized by 32nds of an inch and range from No. 2- $\frac{1}{16}$ " up.



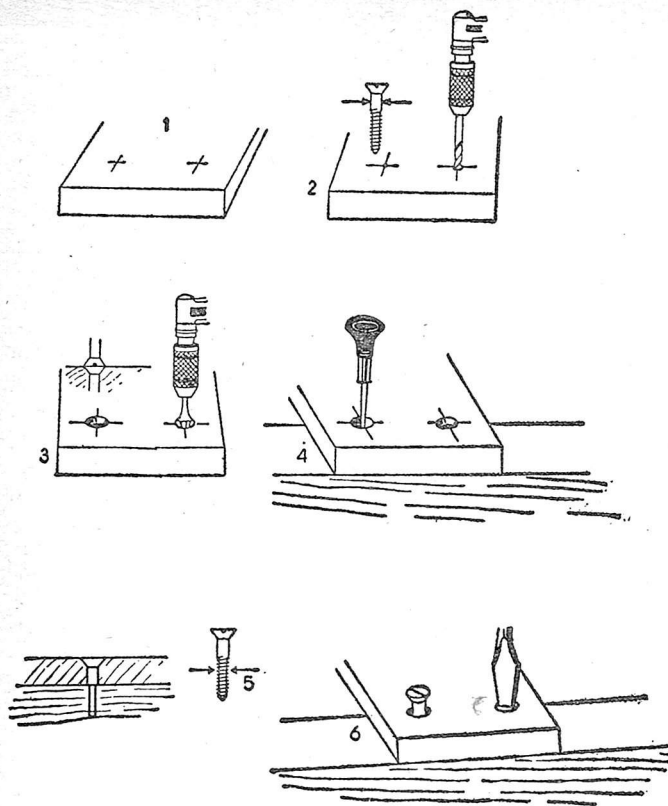
For Bit Brace



For Hand Drill

Countersink bits are used to widen screw holes so that the heads of flathead screws may be flush, or slightly below, the surface of the work.

HOW TO WORK WITH TOOLS AND WOOD

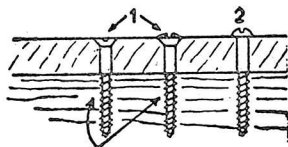


1. Lay out positions of screws from edge and end.
2. Bore holes equal in diameter to thickness of screw shank.
3. Countersink the holes to the diameter of the screw head.
4. Mark location of holes on under piece.
5. Bore smaller holes for threaded part of screw.
6. Drive screws home.

AND NOW ABOUT USING TOOLS

fashion shown on page 72 (the same applies when boring horizontally). One sight shows you whether or not you are holding the bit straight in one plane; the other sight shows you the same thing as to the other plane. This settled you have nothing to do except to turn the handle and give a reasonable amount of pressure on the head of the brace. What could be sweeter? The tool does the work. You can bore just as fast as you wish to, knowing that for the ordinary hole nothing can go wrong, provided you are doing it carefully, until you get near the bottom of the hole. Then turn the brace slowly, watching or feeling for the point of the bit and as soon as it comes through—stop. Now you bore through from the other side. The result is a clean slick hole where you want it. And this ought to give you something to brag about, for it is perfectly true that most men who think they are handy around the house universally bore crooked holes, holes that don't come out where they expect them to, holes that ruin the stock upon which they are working.

Whenever a flathead screw is to be used, you really need three different bits to do a proper job. The first tool is a bit slightly larger than the smooth shank of the screw. You bore this to the depth of the length of that shank. The second part of the hole is made with a bit smaller than the threaded part of the screw or the screw won't do any holding. The third bit that you need is a countersink which widens the hole at the top of the board into which the head of the screw fits, so that

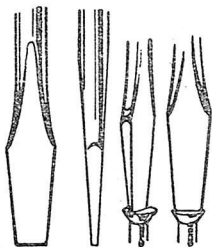
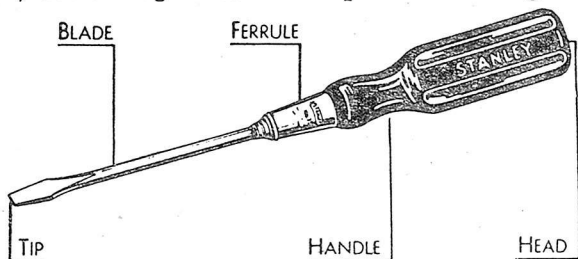


1. Countersink for flat and oval heads.
2. Do not countersink for round heads.

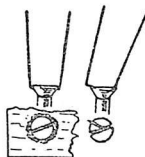
HOW TO WORK WITH TOOLS AND WOOD

the screw is flush with the surface of the top board. Drawings on pages 74 and 75 show exactly how this is done.

A screwdriver looks like such a simple tool. Perhaps that's why so many people have never bothered to master its correct use. First, you should always select a screwdriver of a length and tip fitted to the work. Screwdrivers are specified by the length of the blade. The tip should be straight and nearly parallel sided. It should also fit the screw slot and be not wider than the screw head. (See illustration # 1.) If the tip is too wide it will scar the wood around the screw head, and if the driver is not held in line with the screw it will slip out of the slot and mar both the screw and the work. (See illustration # 2.) Also if the tip is rounded or beveled it will rise out of the slot, spoiling the screw head. (See illustration # 3.) You can regrind or file the tip to make it straight.



1



2



3

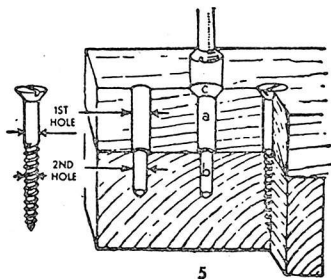
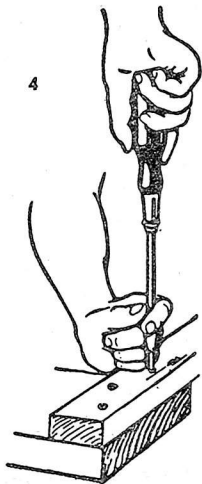
AND NOW ABOUT USING TOOLS

As in the illustration, use the longest screwdriver convenient for the work. More power can be applied to a long screwdriver than a short one, with less danger of its slipping out of the slot. Hold the handle firmly in the palm of the right hand with the thumb and forefinger grasping the handle near the ferrule. With the left hand (if you are right-handed) steady the tip and keep it pressing into the slot while renewing the grip on the handle for a new turn. (See illus. # 4.)

If no hole is bored for the threaded part of the screw the wood is often split or the screw is twisted off. If a screw turns too hard, back it out and enlarge the hole. A little soap on the threads of the screw also makes it easier to drive.

Here are some tips on how to fasten two pieces of wood together with screws.

1. Locate the positions of the screw holes.
2. Bore the first hole in the first piece of wood slightly larger than the diameter of the screw head as in the illustration.



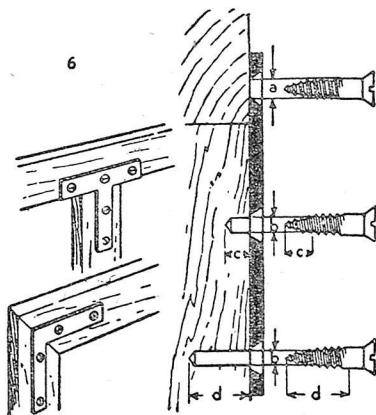
HOW TO WORK WITH TOOLS AND WOOD

3. Bore the second hole slightly smaller than the threaded part of the screw as at 5b. Bore as deep as half the length of the threaded part.

4. Countersink the first holes to match the diameter of the heads of the screws, as at 5c.

5. Drive the screws tightly in place with the screwdriver.

Here are some tips on how to fasten hinges or other hardware in place with screws.



1. Locate the position of the piece of hardware on the work.

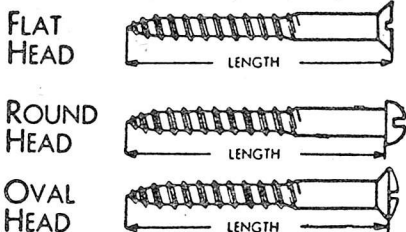
2. Recess the work to receive the hardware, if it is necessary.

3. Locate the positions of the screws.

4. Select the screws that will easily pass through the holes in the hardware, as at illustration 6a.

5. Bore the pilot holes (second hole) slightly smaller than the diameter of the threaded part of the screws, as in b.

6. Drive the screws tightly in place.



If the wood is soft, bore as deep as half the length of the threaded part of the screw, as at 6c. If the wood is hard (for example oak), the screw soft (for example brass), or if the screw is large, the hole must be nearly as deep as the screw, as at 6d. Holes for small screws are usually made with brad awls. For larger screws refer to the chart on page 80.

Exact sizes cannot be given for the holes for wood screws. The following chart shows sizes that are approximately right for average needs. Variations in hard and soft wood, moisture content and snug or loose fits, if desired, should be considered. But a trial fit in scrap wood is practical.

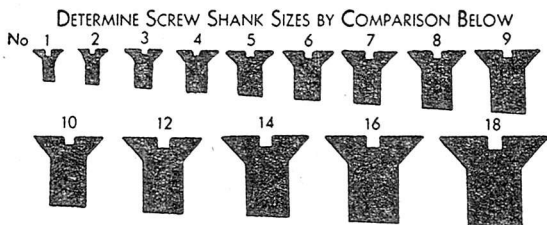
You will be surprised how easily each job you tackle will go from now on and you will soon not be willing to call in an expensive workman to do little jobs around the house and to make little things for you which you could do just as well yourself and have all the economy and fun of doing it besides.

Having completed the bench, you will appreciate from now on the value of a working drawing to scale and its assistance to you in everything you undertake.

You can go ahead and design various things for use around the house if you like. You are well into a hobby which has no superior, in which there is no limit to the skill you can acquire if you want to acquire it. It is indeed an art if it is car-

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ried to the limits of which it is capable. You have only to learn greater skill and the details of more difficult operations. Many of these operations which seem so difficult when you observe the finished product are indeed like those which have already been examined—easy because they are done little by little with care and precision rather than with a slapdash method, careless of detail.



SIZES OF BITS OR DRILLS TO BORE HOLES FOR WOOD SCREWS

NUMBER OF SCREW	1	2	3	4	5	6	7	8	9	10	12	14	16	18
BODY DIAMETER OF SCREW	.073	.086	.099	.112	.125	.138	.151	.164	.177	.190	.216	.242	.268	.294
	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{15}{64}$	$\frac{17}{64}$	$\frac{19}{64}$
FIRST HOLE	TWIST DRILL SIZE		$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{1}{4}$
	AUGER BIT NUMBER							3	3	3	3	4	4	5
SECOND HOLE	TWIST DRILL SIZE			$\frac{1}{16}$	$\frac{1}{16}$	$\frac{5}{64}$	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$
	AUGER BIT NUMBER												3	3

CHAPTER EIGHT

Sharpening the Tools

ONE OF THE BIGGEST SATISFACTIONS you can possibly have when you get interested in tools is to take a dull blade and put a good sharp edge on it, an edge sharp enough to shave a hair off the back of your hand.

The other day when the kitchen knife sharpener had been lost and it seemed impossible to get an edge good enough on the blade of the carving knife to slice rare roast beef I had a sudden inspiration. I opened the kitchen window and with a half dozen firm strokes of the blade across the edge of the sandstone window sill I put a keen edge on the knife and then proceeded to serve dinner. The window sill was smooth sandstone, just the kind of thing grandfather used to use for grinding his farm tools.

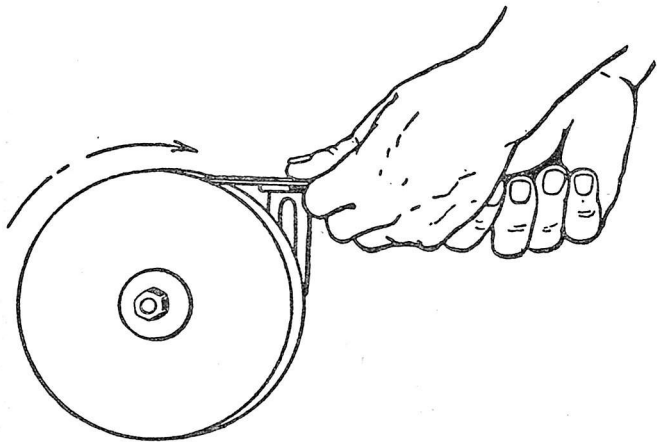
The small piece of natural stone which every carpenter of the eighteenth century carried with him for putting an edge on his tools, as well as the large mill-cut circular stone that was turned with a handle or a foot treadle, has gone out of style because we have learned to make stones which serve our purposes better. The little bench stone, driven by a hand crank, which most carpenters now carry, is often made of natural emery crushed to varying grades of fineness. Artificial materials made in the electric furnace, like corundum, alundum, and carbide of silicon are crushed, sifted, molded, and

HOW TO WORK WITH TOOLS AND WOOD

baked to form stones of every size, shape, and every degree of fineness needed.

For the amateur the common oilstone with a rough surface on one side and a fine surface on the other is all that is necessary. If, in the course of time, you find that the edges and bevels of your tools are worn down badly it may be necessary to have them professionally ground so that you can start all over again, unless you wish to buy or borrow a revolving stone so that you can do your own grinding.

The grinding of edged tools is best accomplished on a wet sandstone grindstone because there is then no danger of burning or drawing the temper from the steel. If a dry emery



Grinding straightens the edge and restores the bevel preparatory to sharpening by whetting on the oilstone. The grindstone should turn toward the plane iron. Use the guide, as it assures a flat, even bevel. Bear on the wheel lightly and dip the plane iron frequently in water to prevent burning or softening the steel.

SHARPENING THE TOOLS

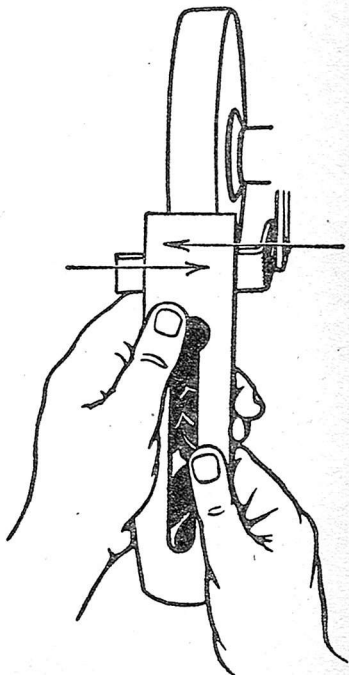
stone is used the tool should be frequently dipped in water to keep it cool.

An improved slow speed electric grinder with a special wheel and an excellent control mechanism is now available. This grinder is highly satisfactory although it uses a dry wheel.

In grinding, the bevel of the tool is placed against the surface of the revolving stone, and either held by hand or clamped in an adjustable guiding device. It is lightly pressed against the wheel, which revolves toward the tool.

The tool should be shifted from side to side evenly across the wheel.

Move the plane iron from side to side to grind all parts of the bevel and to keep the wheel true. The edge should be straight and almost at right angles to the sides of the plane iron.

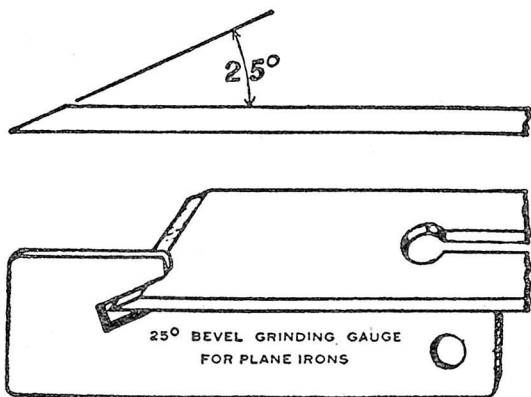


HOW TO WORK WITH TOOLS AND WOOD

The angle of the bevel on chisels and plane blades may vary slightly for soft and hard wood, but for average work an angle of twenty-five degrees will give good results.

An easy way to obtain a good grinding bevel for plane blades is to have the length of the bevel twice the thickness of the blade.

A plane iron bevel gauge is available at a nominal price to check a 25° bevel when grinding the plane iron. If you have one of these, it could be hung near your grinder to check your plane irons while grinding them.



Plane iron bevel gauge.

Honing or whetting your edge tools is done much oftener than grinding them. The grinding of your edge tools should be done only when a new bevel is necessary or when the edge of the tool is nicked.

Perhaps, more than words, the diagrams on pages 86 and 87 will tell you the do's and don't of honing plane cutters and chisels. A light oil should be used on the stone to float the particles of steel and prevent them from filling the pores of the stone. Kerosene or kerosene and light motor oil mixed do

SHARPENING THE TOOLS

very well. The important fact about chisels and plane cutters is that there are two different angles of the blade. One is the grinding angle, the other the whetting angle. It is only the whetting angle that you will ordinarily attack with an oilstone. In whetting, place the bevel down on the stone with the back edge of bevel slightly raised.

Your sharpening problem is to keep the hand absolutely steady, moving parallel to the stone back and forth to insure the use of the entire surface of the stone and avoid wearing hollows in it. You see, if the surface of this oilstone is not a comparatively perfect plane you can't do much with it. You must have the blade approximately square when you get through with the process. When you have cut this bevel on the oilstone at the proper angle of approximately thirty degrees you will find that there is a wire edge on the back of the blade which must be removed. A stroke or two on the oilstone with the back of the blade held perfectly flat on top of the stone will take this off. A refinement can be given to the edge by stropping it a few times on leather or canvas.

There is one excellent way to determine whether or not you have really made a sharp edge and that, strange to say, is by looking at it. A blade which is dull reflects light. A blade which is sharp does not reflect light. So hold your newly sharpened tool where the light will shine on it and if there are no white spots you can know without touching it that it is in good condition for even a trying piece of work.

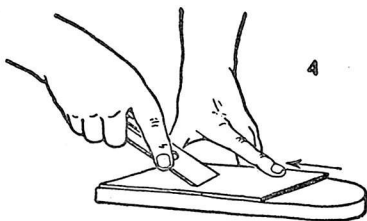
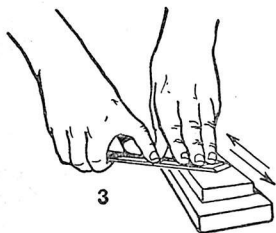
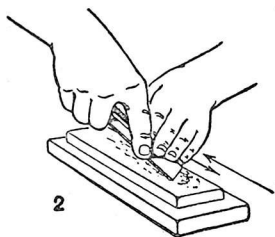
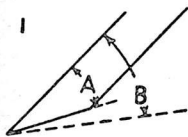
As soon as you are through, the stone should be wiped dry.

Grinding and whetting gouges is of course more difficult than sharpening chisels for the reason that the work must be done on a curve, but the principle is precisely the same as in the sharpening of a chisel.

The gouge with the outside bevel is ground as illustrated on page 88, but it is necessary to have a cone-shaped or round edge wheel for grinding the gouge with an inside bevel.

The illustrations show how to whet the gouge with the outside bevel and the method employed for gouges with the in-

HOW TO WORK WITH TOOLS AND WOOD



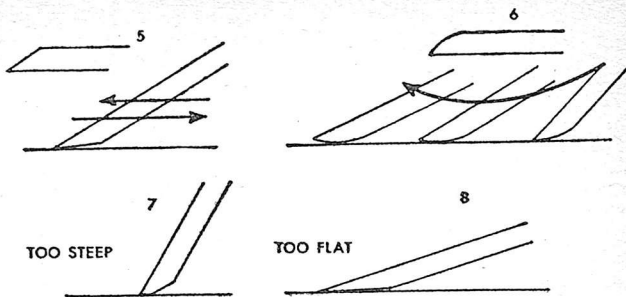
1. Grinding "A" angle, from 25° to 30° . Whetting angle "B," 30° to 35° .

2. Whet the plane iron on the oilstone to produce the real sharp cutting edge. Hold the plane iron in the right hand with the left hand helping. Place the bevel on the stone with the back edge slightly raised. Move the plane iron back and forth.

3. Remove the wire or feather edge by taking a few strokes with the flat side of the plane iron held flat on the stone. Avoid the slightest bevel on this side. If a nick or a shiny edge of bluntness can be seen, repeat both processes of whetting.

4. Finish with a few strokes on a leather strop to produce a keen edge.

SHARPENING THE TOOLS

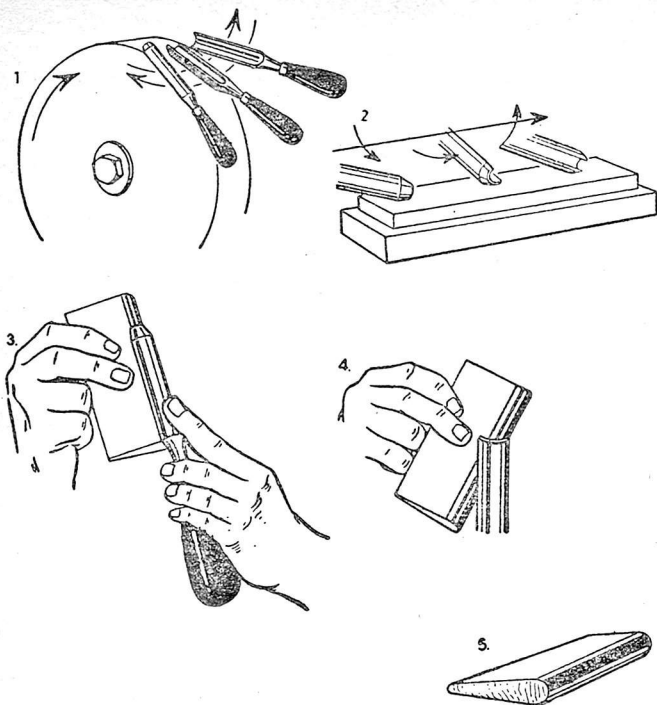


5. Keep the bevel constant by keeping the hands moving parallel to the stone. Avoid rocking.
6. Edge too blunt to cut well.
7. Too steep.
8. Too flat.

side bevel. A slip stone with a round edge is used to remove the wire edge of the gouge with an outside bevel and for whetting the gouge with an inside bevel. The slip stone is held in your hand with care being taken to keep the cutting arc true. It is easy to remove the wire edge of the gouge with the inside bevel because the unbeveled side can be held flat to the stone, but care should be taken to avoid the slightest bevel. The diagrams show better than words how the job is done.

The method is almost the same for sharpening a knife. If the knife is very dull it must be ground first. Remember that this tool is ground on both sides. After grinding lay the side of the blade almost flat on a whetstone and rub it back and forth, that is, both against the blade and with the blade. Repeat this action on the other side. This process is repeated frequently until it is sharp and the wire edge is completely removed. The edge is then finished on a strop.

HOW TO WORK WITH TOOLS AND WOOD



1. Grind the gouge as a chisel, but turn from side to side to keep the shape and to grind all parts to the edge.
2. Turn the gouge from side to side as it is pushed forward on the oilstone to whet the edge.
3. Rub the inside edge of an outside ground gouge very lightly to remove wire edge.
4. Sharpen the bevel edge of an inside ground gouge with a round edge oilstone slip.
5. Round edged oilstone slip.

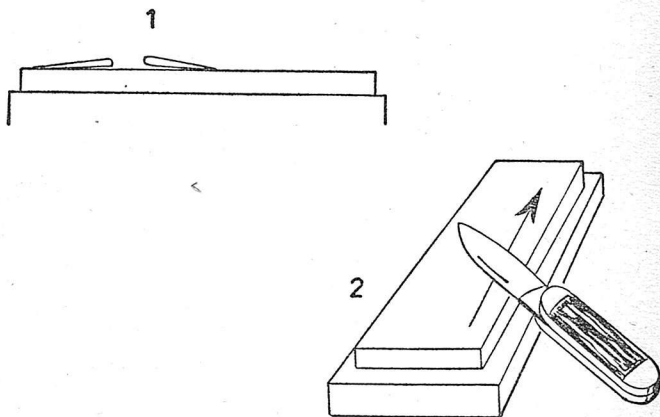
SHARPENING THE TOOLS

Blades for iron spokeshaves are sharpened the same as plane blades. Draw knives are ground as chisels but held in the hand and whetted with an oilstone or slip.

Axes, hatchets, and adzes are ground on a revolving stone and then held in the hand while a whetstone is rubbed against the edge.

Twist drills are reground by holding them in a special rest against the side of a grinding wheel. The cutting edges should be straight and equal in length and the lips sufficiently ground to give clearance. The angle between the cutting edges should be fifty-nine degrees. See page 90.

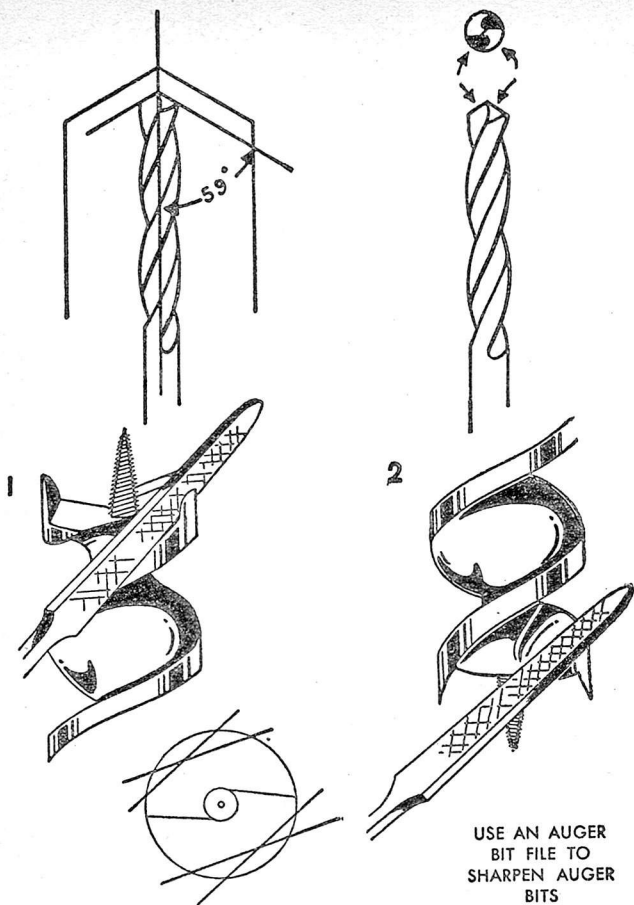
Auger bits are sharpened with an auger bit file and a slip stone. The spurs are sharpened on the inside so as to retain the correct outside diameter. The lips are sharpened on the upper side. The diagrams on page 90 show this.



1. Raise the back of the knife blade very slightly while whetting.

2. Rub back and forth on stone, reverse and whet the other side.

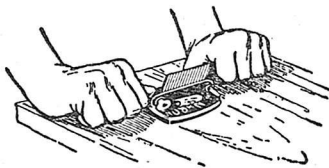
HOW TO WORK WITH TOOLS AND WOOD



1. File the spurs on the inside to avoid reducing the diameter of the bit.
2. File the cutting edge on the side toward the shank to avoid losing clearance on the bottom. Remove the burr with an oilstone slip.

SHARPENING THE TOOLS

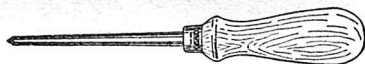
The cabinet scraper, perhaps the cheapest tool you possess, is nevertheless one of the finest tools in the cabinetmaker's chest. When you use it for ordinary jobs, such as scraping paint off something, its condition isn't very important but the cabinetmaker uses it as a tool to do the same kind of work that the smoothing plane does but with an even finer shaving. For ordinary use for scraping old woodwork the edge will be keen enough if you file it while it is held upright in a vise. It is most valuable when you want to take the finest possible shaving from a piece of veneer or perhaps from a particular piece of wood that needs only the slightest bit more actual smoothing to bring it down to its true value. It is also valuable for smoothing or finishing curly grained woods and particularly bird's-eye maple. The smoothing plane would cut too deeply—so you make a tiny smoothing plane out of your scraper, a real cutting tool. Sharpening it for such work is an extremely interesting operation which is easily understood if you realize that each edge of the scraper is to become a little blade to do its work while you draw the scraper across the wood.



Scrapers are made with both square and bevel edges. Cabinet scrapers like the one illustrated, and various other holding devices for these blades, are available, but the blades may also be used in the hands without a holding device.

The following pages will clearly indicate the sharpening and burnishing of these blades. With this ordinary looking tool, known as the burnisher, you actually produce a fine, keen cutting wire edge. This wire edge is capable of doing a

HOW TO WORK WITH TOOLS AND WOOD



Burnisher

smooth scraping job without any tendency of tearing or roughing the wood even on curly hard woods.

If you have ever seen a professional floor scraper operate, I know you were astonished at the beautiful fine shavings he could take off with his scrapers. Perhaps you learned, also, that the edges can be renewed several times with the burnisher by watching him work.

Don't smile when I tell you that one of the most valuable things I ever learned about tools was to use the grindstone on all of my screwdrivers. Properly speaking, of course, a screwdriver isn't sharpened at all—you need it very dull. Actually you can find more grief with a screwdriver which is improperly formed than any other tool I know. If you look at the poor shapes shown in the diagrams below you will see pictures of tools I have owned before I knew any better. I always felt they were like grasshoppers. Such a tool can jump



A good shape for screw driver tips should have sides nearly parallel and ends straight.



Poor shapes will slip out of slots and damage screws and work.

SHARPENING THE TOOLS

out of a screw, cut into the piece of fine finished wood you are working with, in fact drive you utterly mad. With a good screwdriver, properly shaped, you can easily drive home a screw that fits it without much hazard of slipping out of the slot and damaging your work.

Screwdrivers are ground on an emery wheel or grindstone to obtain their correct shape. The edge should be made straight across the end and the faces near the ends parallel or almost parallel to each other. This is necessary to keep the screwdriver from slipping.

Filing a saw is really a job for an expert. I have known men who thought they knew how but they ended up by ruining a saw. That is why I don't recommend you tackle the job yourself. Nevertheless it is a mighty fine thing to know how to do it. You may discover some day when you are in a hurry that the saw you need to use has been used by your wife as a cleaver on a beef bone. The facts about filing the saw (with diagrams) are therefore included in this chapter. One word of warning, however—start your first saw-filing experiment on an old saw and not on your finely geared-up 22-inch cross-cut. In saw filing practice counts.

The saw should first be placed in a saw clamp and the points evened with a flat file or a hand saw jointer.

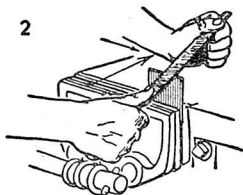
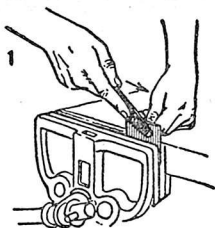
Then set the teeth by bending each alternate tooth to the right or to the left so as to secure clearance for the blade when cutting. Set every other tooth on one side first and then those on the other side.

The really best way is to use the tool made for this work, a saw set. See illustration on page 99.

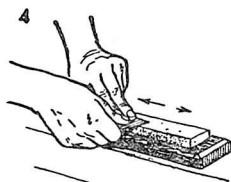
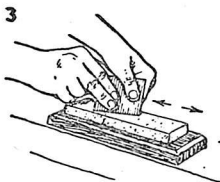
The shape of the body and handle of this tool enables the user to operate it with ease. The saw is held firmly against the gauge while the tooth is being set. The saw teeth are in plain view, which enables the user to adjust the tool quickly to the tooth to be set. The average set for a saw would require the anvil to be so adjusted that the lower line of the bevel be placed about one-third the height of the tooth from the point. It should never be lower than half the height of

HOW TO WORK WITH TOOLS AND WOOD

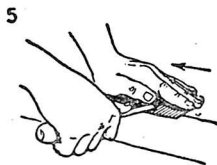
HOW TO SHARPEN A BEVEL EDGE SCRAPER



1. Remove the old burr with a smooth mill file held flat against the face or flat side of the blade.
2. File or grind a bevel of about 45° . Push the file forward and to the side with one sliding motion.

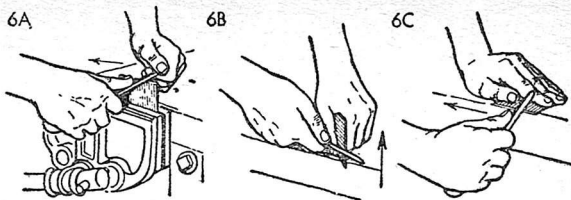


3. Whet the bevel side of the blade on the oilstone.
4. Whet the face side of the blade to remove the wire edge.

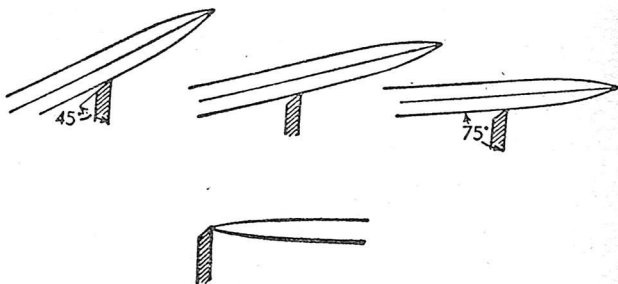


5. Draw the edge with a few firm strokes on the face side of the blade. Hold the burnisher flat on the face side of the blade.

SHARPENING THE TOOLS



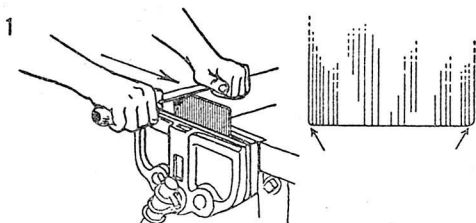
Turn the edge with a few firm strokes of the burnisher on the bevel side of the blade. The scraper can be held in any of the three ways shown above. Draw the burnisher toward you the full length of the blade with a sliding stroke. Some prefer to stroke both ways from the middle towards the ends. A drop of oil on the burnisher helps.



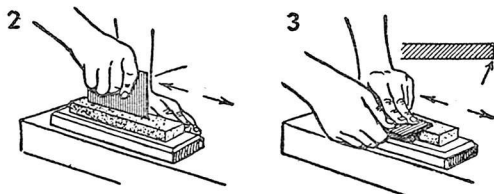
The first stroke should be made with the burnisher held at an angle, a little greater than the bevel. Increase the angle until, at the last stroke, the burnisher is held at about 75° to the flat face of the blade. If the edge should be turned too far over, it can be raised by drawing the point of the burnisher along the edge, under the burr.

HOW TO WORK WITH TOOLS AND WOOD

HOW TO SHARPEN A SQUARE EDGE SCRAPER BLADE

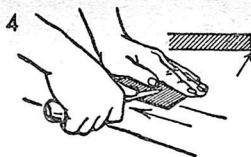


1. *File the edges square and straight by draw-filing with a smooth mill file. Round the corners slightly.*

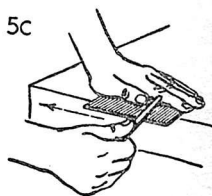
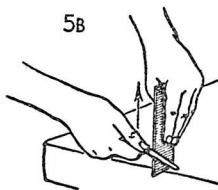
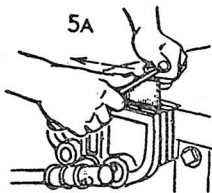


2. *Whet the edge, holding the blade square to the surface of the oilstone. Some prefer to hold the scraper square to the edge of the oilstone.*
3. *Remove the burr by whetting the scraper flat on the oilstone. The edges should be very smooth and sharp.*

SHARPENING THE TOOLS



4. Draw the edge with three or four firm strokes of the burnisher held flat on the scraper.



Turn the edge with a few strokes of the burnisher. The scraper can be held in any of the three ways shown above.

• Draw the burnisher toward you the full length of the blade with a sliding stroke.

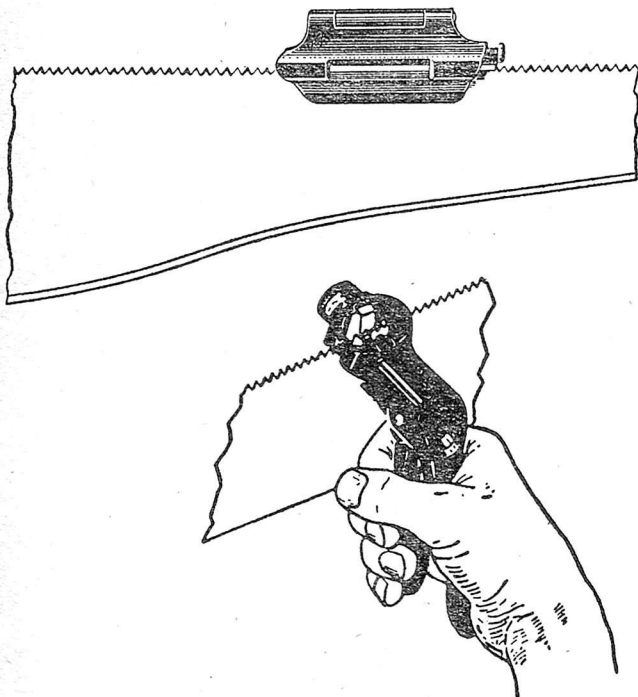
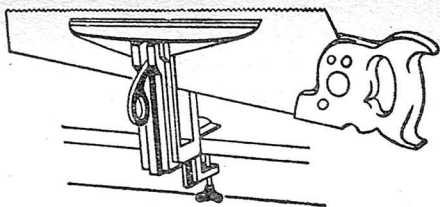


To turn the edges out, the burnisher is held at 90° to the face of the blade for the first stroke. For each of the following strokes, tilt the burnisher slightly until at the last stroke it is held at about 85° to the face of the blade. A drop of oil on the burnisher helps.

HOW TO WORK WITH TOOLS AND WOOD

SAW FILING CLAMP

Hold the saw in a saw clamp for the first step in sharpening. Joint or even the points with a file or special handsaw jointer, shown below.



The second step is to set or lightly bend out every other tooth to secure clearance for blade when cutting.

SHARPENING THE TOOLS

the tooth, as this may cause the blade to spring or crack and is liable to break out a tooth.

Another method of setting the teeth of a saw is by the use of a hammer and a special anvil, giving each tooth a sharp blow. This method, however, requires much skill.

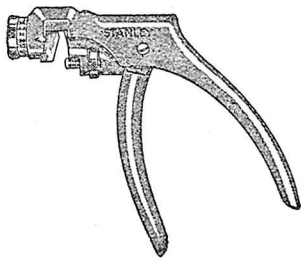
The set of a saw varies according to the work, soft, wet wood requiring more set than dry hard woods.

The saw is next ready for sharpening by filing the teeth with a three-sided blunt or taper file.

The workman takes his position at the left of the clamp and at the point of the saw.

For crosscut saws, the file is held at an angle of forty-five degrees and allowed to drop into the gullet between the first and second tooth. This position of the file determines the location for each succeeding stroke. Each alternate tooth is filed, working from the point to the handle, filing against the front edges of the teeth. The saw is then turned around and the workman changes his position to the right side of the clamp. The remaining teeth are then filed in the same way.

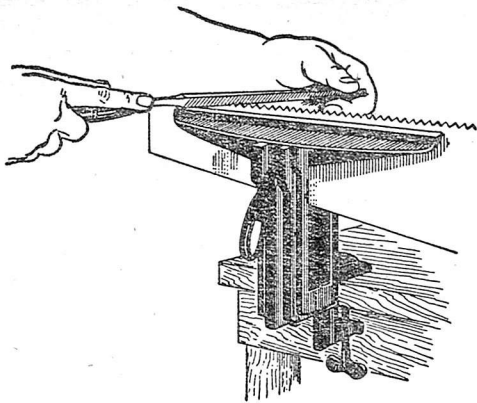
After the teeth have all been filed, the saw is laid flat on the bench. A file or an oilstone is gently slipped over the sides of the teeth to correct any slight differences in the set and also to remove any wire edge.



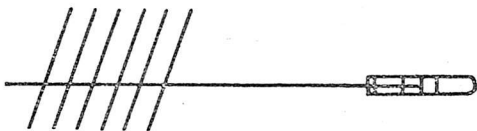
Saw Set

HOW TO WORK WITH TOOLS AND WOOD

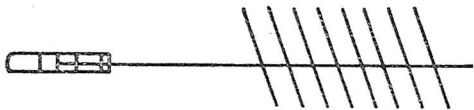
TO FILE A CROSSCUT SAW



Let the file settle into the gullet to find its proper position in order to keep the teeth the same shape as when new.



Begin at the point, turn the file to an angle of 65° toward the handle and file every other tooth.

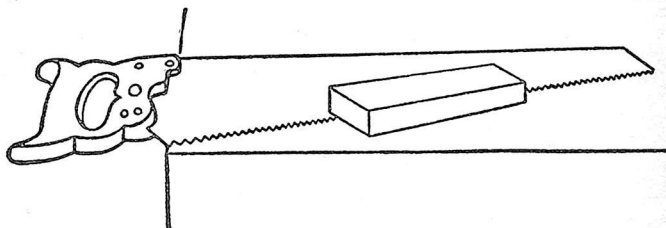


Reverse the saw and file the intervening teeth the same as before.

SHARPENING THE TOOLS



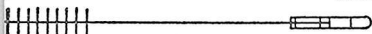
Crosscut saw teeth



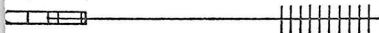
The sides of the teeth should be very lightly dressed with a file or oilstone after filing to even the set and to remove any burr or wire edge from filing.

TO FILE A RIPSAW

PREPARE BY JOINTING AND SETTING THE TEETH
AS FOR A CROSS-CUT SAW



FILE EVERY OTHER TOOTH FROM POINT TO HANDLE AT RIGHT ANGLES TO THE LENGTH OF THE BLADE



REVERSE THE SAW AND FILE THE INTERVENING TEETH

HOLD THE FILE STRAIGHT ACROSS



RIP SAW TEETH

SIDE DRESS RIP SAW THE SAME AS
IN SHARPENING A CROSS-CUT SAW

HOW TO WORK WITH TOOLS AND WOOD

Some expert saw filers claim that the saw should be filed from the handle toward the point, contending that the file can more readily find its position in the gullet and that the original angle and shape of the teeth can be more easily retained. Working in this way, the file is sharpening the front edge of the tooth, that is, set away from the operator and is cutting as it moves away from the edge. This has a tendency to produce a wire edge. By the other method the file cuts as it moves toward the edge of the tooth bringing it up keen and clean. This holds true when grinding a chisel or knife, less wire edge being made when the stone revolves toward the tool edge.

A rip saw is jointed and set in the same manner as the cross-cut saw. The file is held at right angles to the blade and when each alternate tooth has been filed, the saw is reversed and the intervening teeth sharpened.

There is apt to be a slight inequality of pressure during a file stroke, which would cause the saw to run off the line if all the teeth were filed from one side. This is equalized by filing alternate teeth from opposite sides.

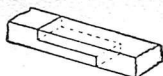
CHAPTER NINE

More About Putting the Pieces Together

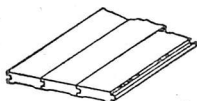
MOST AMATEURS never expect to get much beyond using a plane, a saw, a screwdriver, and a hammer with reasonable skill. But if you will follow in the shop the various processes which have been described on previous pages you will undoubtedly find that your skill is greater than you supposed. You have already stepped beyond the ordinary householder and into the department of joinery. The moment you have put two pieces together—jointed two members—you have stepped into this department, although, of course, in its proper meaning joinery refers to the inside work of constructing and installing the fittings of a house.

No one would dignify the nailing together of a couple of members with the term joinery. Nor would a craftsman regard even the joining of members with bolts and screws as within the department. But the moment you make a mortise or a mitre you are doing the kind of work that the joiner regards as peculiarly his. The cabinetmaker into whose department you venture as soon as you make the simple bookrack, or the most elaborate inlaid writing desk, is first of all a joiner who puts together the members upon which he is working with fitted joints and hot glue. He even objects, as an artist, to using screws which will be hidden away. He uses dowels of wood. The strength of his joints depends upon the type he

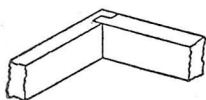
HOW TO WORK WITH TOOLS AND WOOD



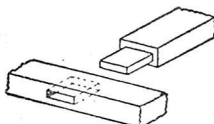
HALF LAP



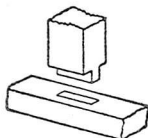
TONGUE & GROOVE



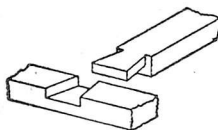
DADO & RABBET



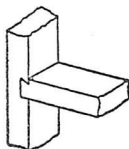
THRU MORTISE TENON



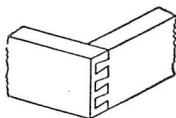
STUB MORTISE TENON



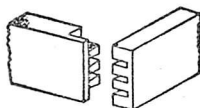
LAP DOVETAIL



DOVETAIL DADO

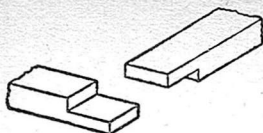


LAP DOVETAIL OR HALF
BLIND DOVETAIL

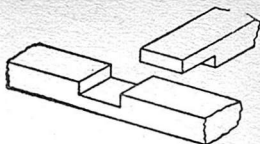


STOPPED LAP DOVETAIL

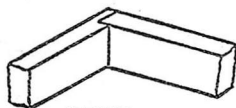
MORE ABOUT PUTTING THE PIECES TOGETHER



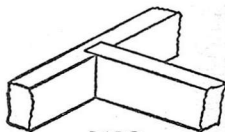
END LAP



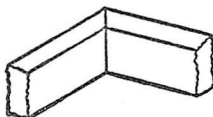
MIDDLE LAP



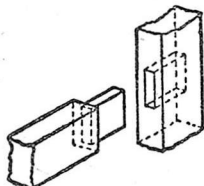
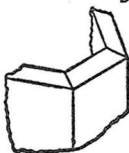
RABBET



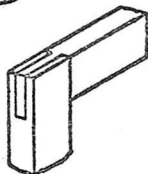
DADO



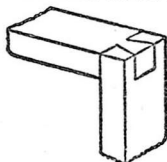
MITRE



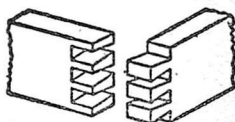
BLIND MORTISE TENON



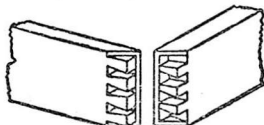
OPEN MORTISE TENON



THRU SINGLE DOVETAIL



THRU MULTIPLE DOVETAIL



BLIND MITRE OR SECRET DOVETAIL

HOW TO WORK WITH TOOLS AND WOOD

chooses and the quality of the fitting. The carpenter working with rough materials achieves strength by using large pieces and by the position in which he puts those pieces. Men have been working so long with wood that they have, of course, invented innumerable joints. But the fact of the matter is that each joint which you might attempt to make is nothing more or less than a further adventure with the plane, the saw, and the chisel. The simpler the joint, as in the stub tenon and mortise used on the bookrack in an earlier chapter, the less cutting and fitting there is to be done. That is why some joints are easier to make than others and that is one reason why the simpler joints are chosen for simple structures.

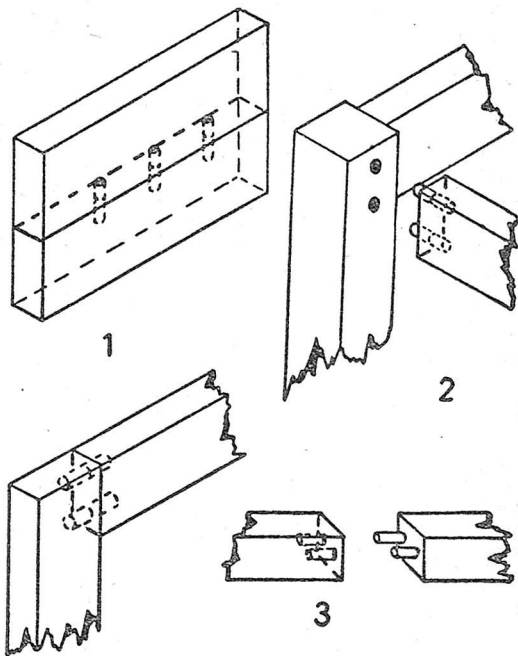
If you were to decide to make a set of screens for your house it would be poor judgment, from the joiner's point of view, to put together the stiles and rails with elaborate dovetail joining, although such a joint might be perfectly good after you had worked it out on the various members. Obviously your choice for such work should be the simplest strong joint you can think of. An end lap joint would join the top and bottom rails. The center rail could be fastened to the stiles with a middle lap joint. A full length screen can be made thus with six joints, one for each end of the three horizontal members. Of course, such simple joints require fasteners. They do not fasten themselves, as do the more elaborate joints which are to be described here. The fact is that you can make very acceptable screens by fastening these joints with eight-penny nails (although screws would give you a better job), or they can be doweled.

You can also make such a thing as a drawer without using any elaborate joints at all, although the best drawer construction requires, without a doubt, the dovetailing of the front board on which so much strain comes when you are opening the drawer. Again for putting together the four sides of the drawer you could use a plain rabbet joint nailed instead of the elaborate dovetail.

The moment, however, you want to make a drawer which

MORE ABOUT PUTTING THE PIECES TOGETHER

is a real drawer, you are faced with the necessity of making a dovetail corner. You can use dowel pins to hold the two ends of the drawer to the front board, which will give you a workmanlike joint. It will be quite strong and much easier to make than the dovetail. It requires only the usual careful fitting of this simple joint and the insertion of three or four dowel pins.



1. Dowels used to strengthen long jointed edges.
2. As a substitute for mortises and tenons in the legs and rails of chairs and tables.
3. To join stiles and rails in frames and where ends are squarely butted together.

HOW TO WORK WITH TOOLS AND WOOD

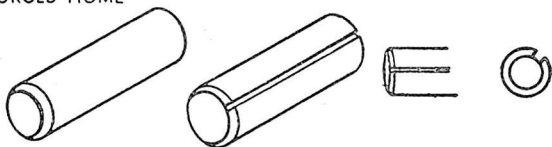
Glue, of course, should also be used in putting this joint together.

As a matter of fact the dowel pin method, which is much stronger than nailing and much more acceptable in all furniture than either nailing or screwing, is perfectly easy. For illustration showing how dowels are often used, see page 107.

Dowels are round wooden pegs cut a trifle shorter than the sum of the depth of each of the two holes into which they are set. Each of the dowel pins is slightly chamfered with a knife or dowel sharpener to prevent binding when they are forced into place. Usually also there is a little V-groove cut in a dowel pin with a knife or saw the entire length of the peg to permit the escape of excessive glue and imprisoned air when the dowel is driven in. Such a little groove prevents splitting the piece upon which you are working.

Dowels can be purchased at any hardware store. They are

DOWELS SHOULD BE SLIGHTLY CHAMFERED
A GROOVE PERMITS THE GLUE TO ESCAPE FROM
THE BOTTOM OF THE HOLES WHEN THE DOWELS
ARE FORCED HOME



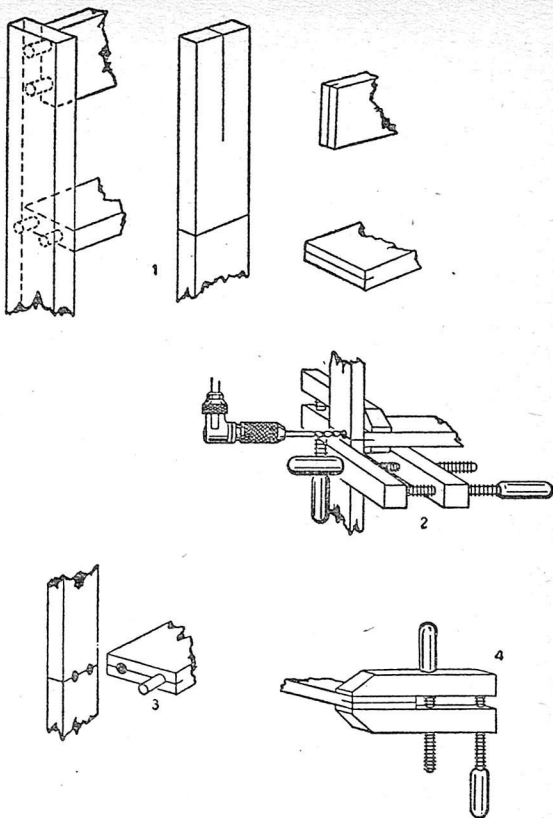
DOWEL HOLES CORRECTLY CENTERED

OFF CENTER

SURFACES NOT EVEN

NOT PERPENDICULAR TO SURFACE
THROWS THE FACES OUT OF LINE

MORE ABOUT PUTTING THE PIECES TOGETHER



Doweled butt joints.

- 1. Pieces marked so that they may be clamped together and dowel holes correctly centered, bored in both at one time.*
- 2. Boring dowel holes.*
- 3. Holes bored ready to glue.*
- 4. Method of clamping together while boring.*

HOW TO WORK WITH TOOLS AND WOOD

usually made of maple or birch and come in various diameters from 1/4 inch to 3/4 inch in three-foot lengths.

To prove the accuracy of the location and boring of dowel holes the work should be clamped together without glue for a trial. If the dowel holes are not in alignment, a dowel should be glued into one or both; you then cut off flush and rebore.

To make a dowel butt joint, as illustrated at upper left in drawing on page 109, proceed as follows: Gauge a line on one piece in the middle of the end, parallel to the face and a little way down each edge so that it may be located when covered up.

A line is then gauged parallel to the edge on both faces of the second piece. A hand screw is clamped to the first piece with its side even with the end. This in turn is clamped to the second piece, with the ends of the line on the first piece matching the line on one face of the second. Dots are placed on the line on the outside face of the second piece to mark the centers of the dowel holes. The auger bit is then centered on these dots and each hole is bored in both pieces of wood and if they are carefully clamped together the holes will match.

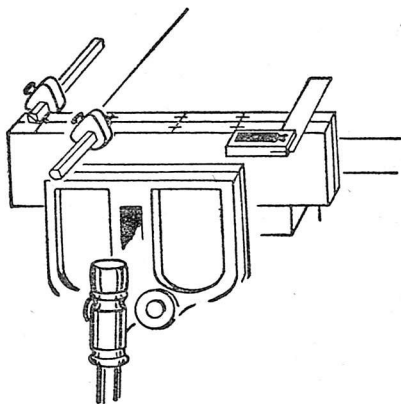
For the dowel butt joint at the left in sketch on page 109, a line is squared on the edge of the second piece, squared across both faces and the opposite edge. This will give you the guide lines for this joint. Clamping with hand screws and the boring of holes are the same as above. Often it is not desirable to have dowels come through either for appearance sake or because the wood is too thick.

Blind dowel holes may be laid out in several ways. The two pieces may be clamped together with the butting surfaces flush with each other. Lines are then squared across both surfaces at the same time, showing the location of the dowels. They may then be taken apart and gauge marks made from the "work faces," crossing the squared lines, thus locating the centers of the dowel holes.

Another way is to gauge a line in the middle of the end of

MORE ABOUT PUTTING THE PIECES TOGETHER

one piece parallel to the "work face." Then square lines across the end, square to the "work face," the correct distance from the "work edge." Where these lines cross are the centers for the dowel holes. A line is squared or gauged on the second piece to correspond to the center line gauged on the end of the first piece. The arris (corner) of the piece is matched to



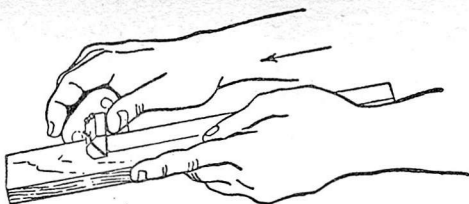
Centers for dowel holes may be marked by placing two pieces of wood together, edges even, work face out. Square lines across both pieces the required distance from the ends. Set the gauge in order to locate the crossing lines, showing the distance of the holes from the edges.

this line with the first piece held the correct distance from the end. The location of the squared lines is then transferred to the line on the second piece with an awl, knife, or sharp pencil, as shown on page 113.

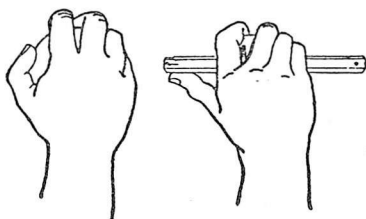
If many pieces are to be marked alike, it will save time and result in more accurate work if a wood or metal template (pattern) or marker is made.

After setting out the centers for the holes, they should be carefully bored with an auger bit, square to the surface of the

HOW TO WORK WITH TOOLS AND WOOD

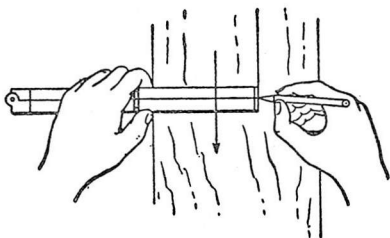


1. Press the head tightly against the wood.



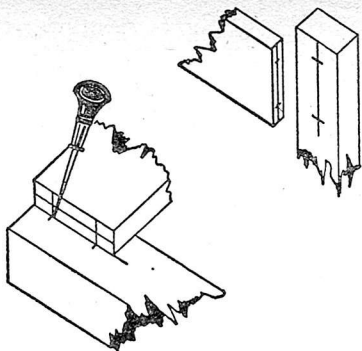
2. Grasp the gauge like a baseball.

3. Then thrust the thumb out and push gently forward.

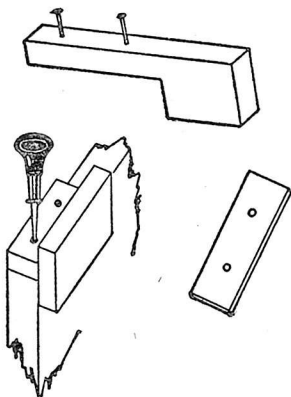


The rule and pencil may be used like a gauge.

MORE ABOUT PUTTING THE PIECES TOGETHER



Centers for dowel holes may be located by marking them on end of the rail with gauge and square, then on the legs, gauging the distance from the edge with the rail held in place and matching this line. The centers are marked off on the line on the leg. The awl makes a good hole for centering a bit.



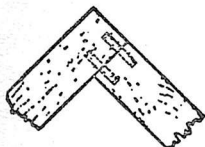
Where many dowel holes are to be marked, similarly spaced, it may be done with nails driven into a block or with an awl through holes in wooden or metal templates.

HOW TO WORK WITH TOOLS AND WOOD

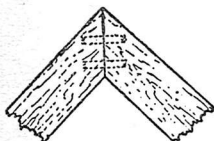
wood. A bit gauge may be used to regulate the depth of the holes.

There is a tool, the doweling jig, designed especially for this work. It enables the user to bore dowel holes in the edge or end of work with ease and accuracy. It will take any thickness of material up to three inches. It is an excellent bit guide for mortising.

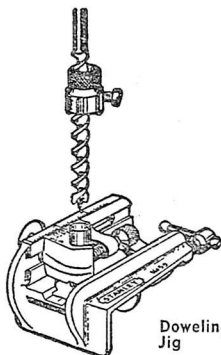
The pieces are clamped together and the lines squared across the edges or ends as the case may be. The instructions with the illustrations on the following pages show clearly how this tool is operated.



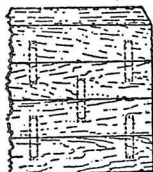
DOWELED CORNER JOINT



DOWELED MITRE JOINT



Doweling Jig



DOWELED STOCK

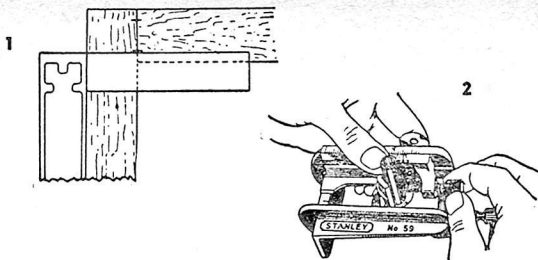


MORTISING

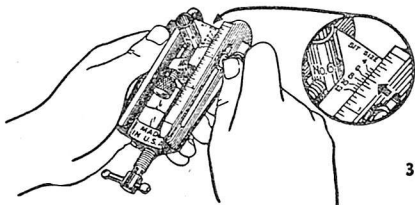
GUIDE SIZE	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"
BIT SIZE	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8

Depth gauge and six guides are furnished with Stanley Doweling Jig—to bore holes for $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and $\frac{1}{2}$ inch holes.

MORE ABOUT PUTTING THE PIECES TOGETHER

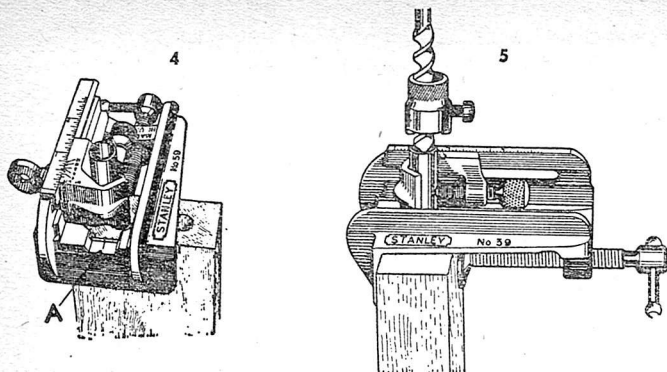


1. Indicate on face side of work a center line for any number of dowels desired.
2. Select a suitable size dowel for your wood and the same size guide. Secure the bevel end up in slide with bottom of guide practically flush with under side of the guide.

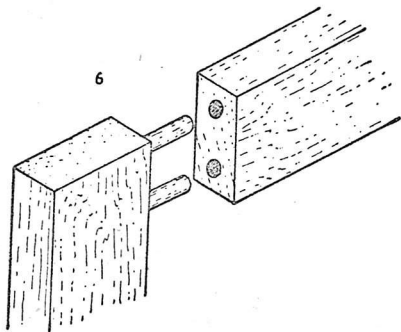


3. Adjust the slide, aligning the index line for the guide selected at the proper graduation to bring the center of the hole the distance desired from the face side of the wood. An index line is given on the slide for each guide or bit size. Example: For a $\frac{3}{8}$ " guide, adjust the slide to bring the index line No. 6 to the desired graduation mark. If the dowel is to be in the middle of a 1" piece of wood, adjust the slide to the $\frac{1}{2}$ " graduation mark and fasten securely with thumb screw.

HOW TO WORK WITH TOOLS AND WOOD



4. Place the jig on one of the pieces of stock with the fence next to the face side of the wood, and bring the center line "A" in alignment with the mark on the wood, illustrated in No. 1. Clamp the jig securely.
5. Place the bit of proper size into the guide using care not to strike the cutting edges of the bit against the guide. Bore for each hole to desired depth, using depth gauge clamped on bit.



6. Place dowels in hole and complete the joint.

MORE ABOUT PUTTING THE PIECES TOGETHER

The cylinder locates the hole the correct distance from the face and guides the bit perpendicularly to the surface. The bit gauge furnished with the jig regulates the depth of the holes.

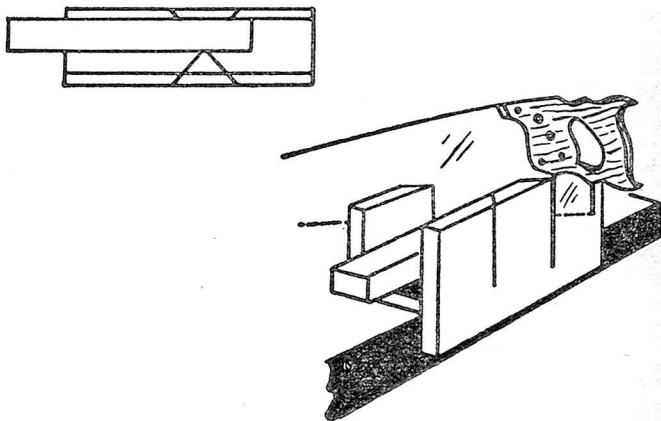
Another joint which you might have used in making your screens is one of the very commonest that there is—the mitre. You use it on door frames, always on picture frames, and even on pieces of furniture.

Mitre joints are butt joints with the angle at the corner halved between the two pieces. The mitre is cut at an angle of forty-five degrees, that is, half a right angle.

A forty-five degree mitre may be laid out by squaring a line across the face of the wood, then measuring along one edge, a point equal to the width of the wood, and connecting this point with the other end of the squared line.

Mitre joints are usually sawed in a mitre box. Below is an illustration of a homemade box.

There are also on the market patent mitre boxes made of metal. These mitre boxes are accurate machines for cutting wood to any angle from thirty to ninety degrees.



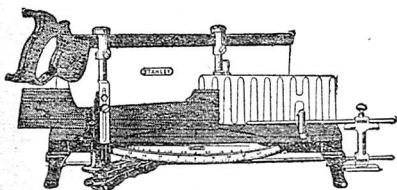
A homemade mitre box

HOW TO WORK WITH TOOLS AND WOOD

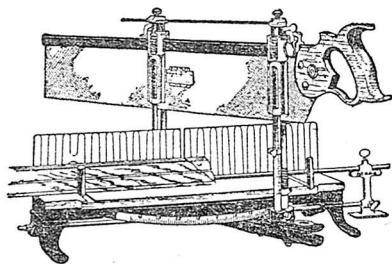
They have many unique features, including catches with automatic release for holding the saw above the work, and releasing when ready to cut, a length stop for duplicating pieces of a given length.

The quadrant is graduated in degrees and numbered for cutting 3, 4, 5, 6, 8, 12 and 24 sided figures. The illustrations below show large complete mitre boxes. There are also available smaller boxes which are less expensive.

Mitre joints are usually nailed, or nailed and glued together. When nailed and glued together a picture frame vise is generally used or some other special clamp. They may be strengthened with dowels, tongues or slip feathers, which are sometimes used.



No. 2246



No. 246

Two types of mitre boxes

MORE ABOUT PUTTING THE PIECES TOGETHER

Doweled mitre joints are doweled the same as butt joints.

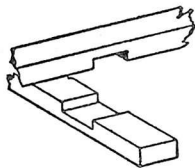
In tongued mitre joints each piece is grooved, and a tongue or spline is glued in, giving greater strength through the larger gluing surface, and preventing the pieces from warping.

A slip feather mitre joint has a groove cut part way through it with a saw, into which is glued a thin piece of wood. The excess wood is then trimmed.

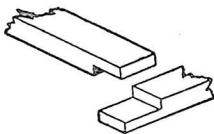
Notched and halved joints are perhaps those with which all of us, from our earliest memories, are most familiar. We have referred to them in the first part of the chapter for the construction of screens.

There are many varieties of notched and halved joints. The most important and most frequently used are the middle half-lap, end half-lap and the half-lap with a rabbet.

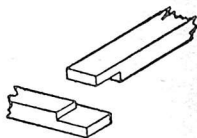
The middle half-lap is laid out by superimposing each piece upon the other to mark the width of each cut.



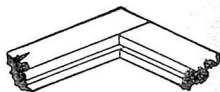
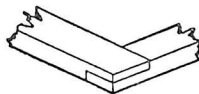
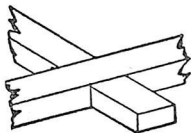
HALVED CROSS
LAP JOINT



CORNER OR END HALF
LAP JOINT

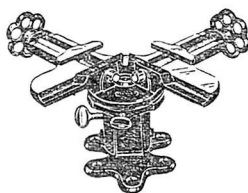
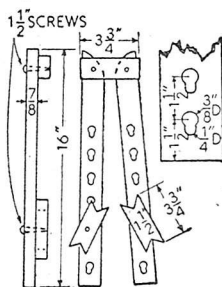
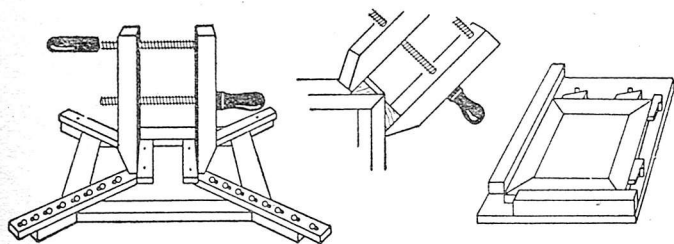


CORNER HALF LAP
WITH RABBET



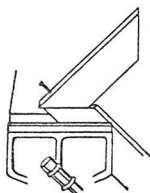
HOW TO WORK WITH TOOLS AND WOOD

METHODS OF CLAMPING AND GLUING MITRES



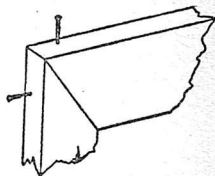
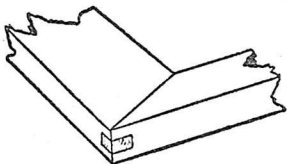
MITRE VISE

ALLOW FOR SLIP
WHEN NAILING
THIS WAY

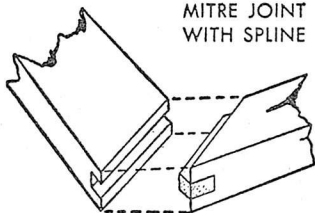


MORE ABOUT PUTTING THE PIECES TOGETHER

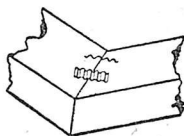
The pieces may also be clamped together and the lines for the width of the cut squared across both "work edges" as far apart as the wood is wide. This is sometimes done from a center point measuring half of the width of the wood on each side of the point. The pieces are then taken apart and the square lines continued across the "work faces" and down on the other edge. The depth of each cut is equal to one-half of the thickness of the pieces and is gauged from the "work



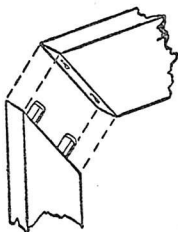
MITRE JOINT
WITH SPLINE



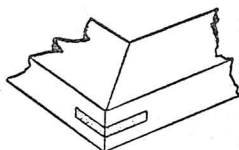
NAILED OR NAILED AND
GLUED MITRE JOINT



MITRE CORRUGATED
NAILS

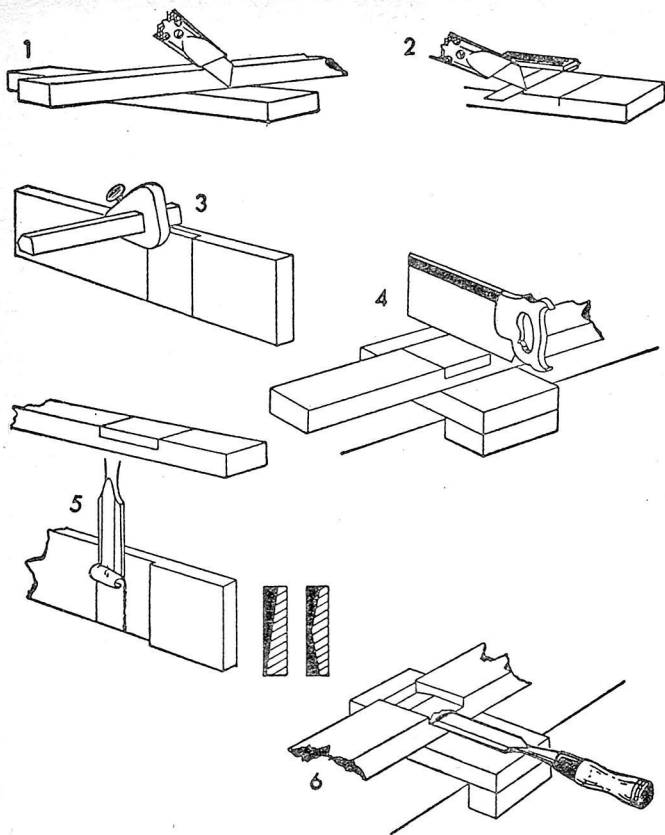


DOWELLED MITRE



MITRE WITH
FEATHER JOINT

HOW TO WORK WITH TOOLS AND WOOD



1. Mark the width of the notches.
2. Square with shoulder lines on face and edge.
3. Gauge the depth of the notches.
4. Saw the shoulders.
5. Chisel to the gauge line on each side. To avoid breaking the grain slant the chisel slightly outward.
6. Then finish to a uniform depth.

MORE ABOUT PUTTING THE PIECES TOGETHER

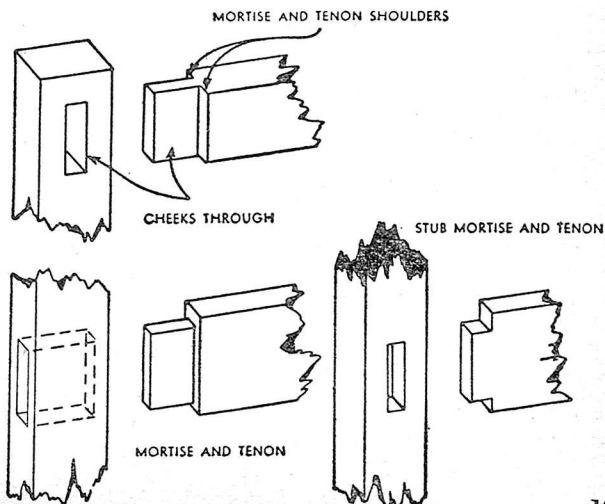
face" of both pieces. One piece is cut above the depth line and the other piece is cut below it. The sides or shoulders are then sawed on the waste wood outside of the line. The waste wood is removed to the gauge line by paring if necessary.

It is an aid in chiseling wide cuts to make several saw cuts between the shoulders almost to the gauge line, before chiseling out the waste wood.

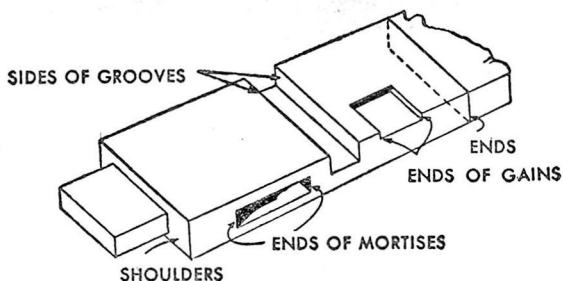
The end half-lap joint is laid out and cut in the same manner as the middle lap joint except that as there is only one shoulder to be cut, the line of the bottom is gauged across the end. As the bottom is accessible from the end, it may be sawed out and then trimmed to line with the chisel if necessary.

The half-lap joint with a rabbet is laid out and cut in the same way as the other lap joints except that one shoulder is marked close to the end to allow for width of the rabbet.

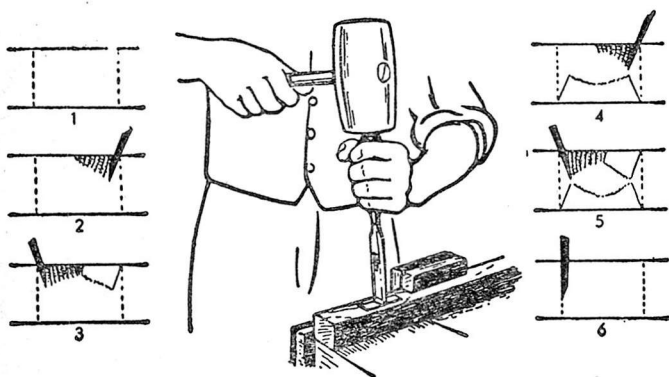
You know, of course, the general principles of the mortise and tenon joint because it has already been described in telling how the bookrack is put together.



HOW TO WORK WITH TOOLS AND WOOD



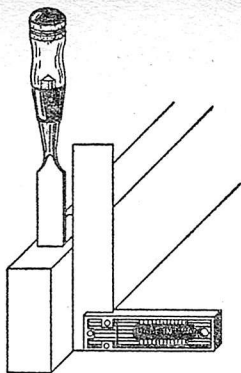
THE TRY SQUARE IS USED TO MARK GUIDE LINES SQUARE TO EDGE OR FACE



Beating out a mortise.

1. Start in the center.
2. Pry out the first chips.
3. Cut each way to end.
Bevel to mortise.
4. Chisel out chips and repeat on opposite side.
5. Chisel out chips until through.
6. Finish by truing ends.

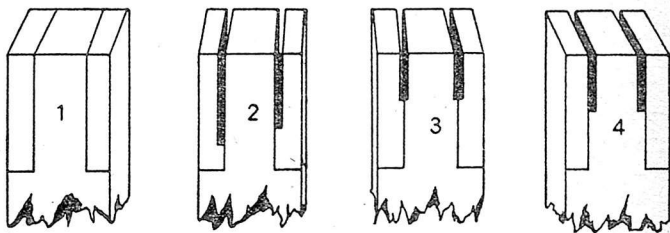
MORE ABOUT PUTTING THE PIECES TOGETHER



Test for perpendicularity.

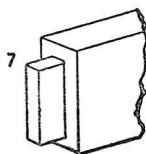
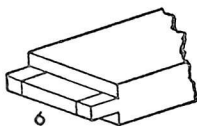
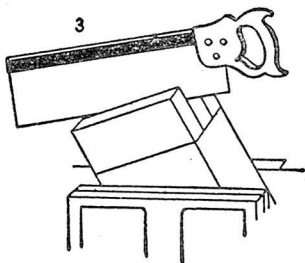
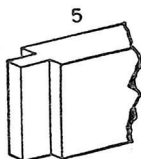
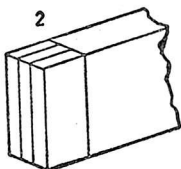
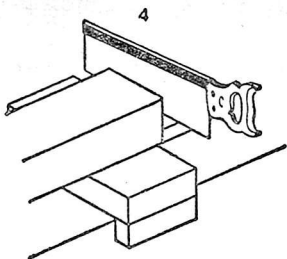
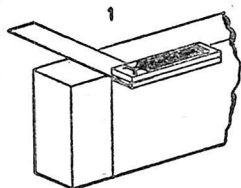
In cutting out a mortise the waste wood is generally removed by boring a row of holes with an auger bit and trimming the cheeks straight and smooth to the line with a chisel. In order to accomplish this, keep the chisel perpendicular to the face of the wood.

The illustration on page 124 shows where the try square is used for marking guide lines for the tenon, ends of mortises, grooves, gains and for the squaring of an end.



1. Tenon marked out.
2. Correct—Saw on waste side of line—tenon left full size.
- 3 and 4. Incorrect—Sawed on line or inside of line—making tenon too small.

HOW TO WORK WITH TOOLS AND WOOD



1. Square lines for shoulder marking length of tenon.
2. Set the mortise gauge and use the same setting between spurs to mark both tenon and mortise for thickness of tenon and width of mortise. If the marking gauge is used be sure to draw both lines from the work face.
3. Saw cheeks.
4. Saw shoulders.
5. If necessary finish with a chisel.
6. Mark shoulders on the edges.
7. Saw shoulders on the edges and finish with a chisel.

MORE ABOUT PUTTING THE PIECES TOGETHER

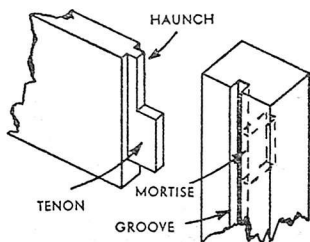
Mortises may be beaten out with the chisel alone. This is done by driving the chisel, held squarely, with a mallet starting in the center and working to each end. The back of the chisel faces the ends. The tenon should be tried in the mortise and any part that binds noted and corrected. Glue can be spread evenly on all abutting surfaces and the work clamped together.

The haunched mortise and tenon below is used in the corners of panel doors. The rails and stiles have grooves to hold the panel. This joint has a short tongue from the top cheek of the tenon to the edge of the wood to fill the part of the groove between the mortise and the end that otherwise would be left open.

The cheeks parallel to the faces and their shoulders are marked and cut in the usual manner. The length of the haunch is then measured and squared as long as the groove is deep. The cheeks parallel to the edges are gauged and the work sawed to the lines. The mortise is laid out and cut as usual except that the mortise is at the bottom of the groove which is intended to hold the panel.

The pinned mortise and tenon joint is one in which a hole is bored through the sides of the mortise and through the tenon, with a dowel or pin inserted.

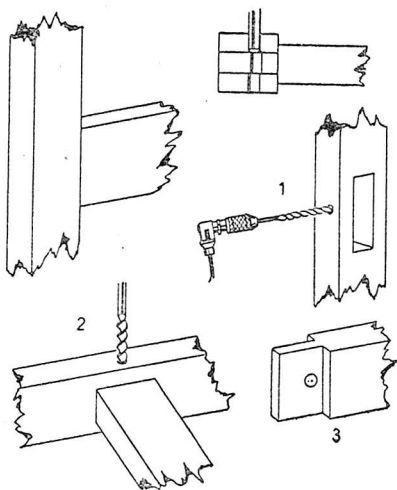
The mortise and tenon is laid out and cut as usual, and a hole is bored through the sides of the mortise with an auger bit. The tenon is then inserted and the center of the holes in the sides of the mortise marked on it. The hole in the tenon is



HOW TO WORK WITH TOOLS AND WOOD

bored slightly closer to the shoulder. This is necessary so that when the joint is closed and the pin is driven into the offset hole, the shoulders are drawn up tightly and held securely. Strength is imparted to the joint independently of the glue.

Wedged mortise and tenon joints are laid out and cut in the same manner as the other mortise and tenon joints except that the mortise is given a flare on the side away from the tenon shoulder.

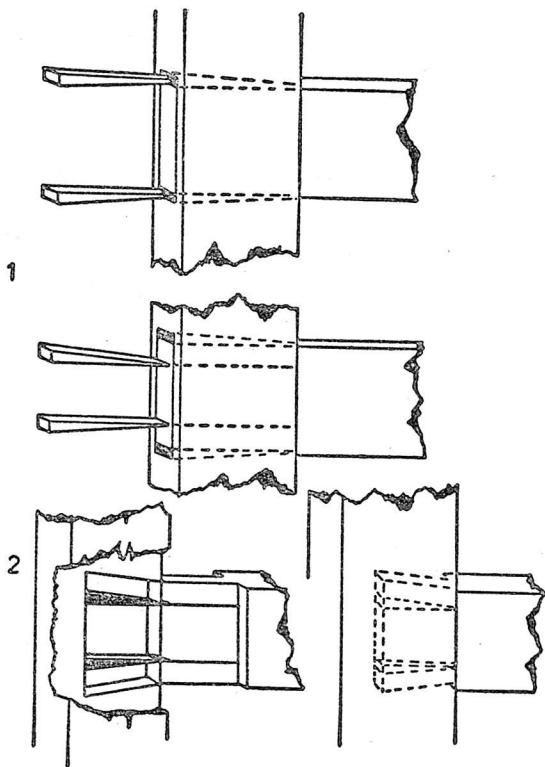


Draw bored and pinned mortise and tenon.

- 1. Bore hole through the member containing the mortise.*
- 2. Insert tenon in mortise and mark center of hole with bit.*
- 3. Bore hole a little closer to the shoulder so that pin, when driven, will draw up the shoulders tightly.*

MORE ABOUT PUTTING THE PIECES TOGETHER

When the joint is glued up, wedges with glue are driven between the tenon and the end cheeks of the mortise. Sometimes two saw kerfs are made in the tenon and the glued wedges driven into them. A foxtail mortise and tenon is a wedged blind mortise and tenon. The wedges are started into the saw kerfs before inserting the tenon into the mortise. When

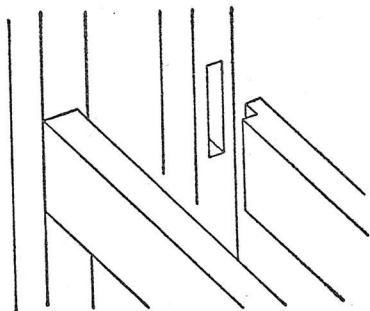


1. *Wedged mortise and tenon joints.*
2. *Fox-tailed mortise and tenon.*

HOW TO WORK WITH TOOLS AND WOOD

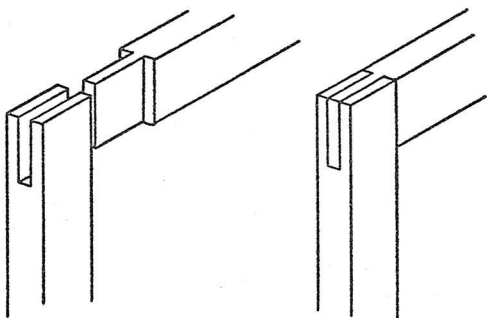
the joint is closed, the wedges are driven deeply expanding the tenon by being pressed against the bottom of the mortise.

A bare-faced mortise and tenon is one with one cheek and one shoulder cut.



Bare-faced tenon.

An open mortise and tenon or slip joint is used on corners. It is like a through mortise and tenon with one end of the mortise removed.



Open mortise and tenon or slip joint.

MORE ABOUT PUTTING THE PIECES TOGETHER

The only difference is marking and cutting the mortise. The gauge lines for the mortise are extended across the end. The cheeks are sawed in the same way as the cheeks of the tenon, the saw being placed in the waste portion of the wood. The waste wood is finally removed by boring a hole near the inner end of the mortise and trimming with a chisel or by beating out with a mallet and chisel.

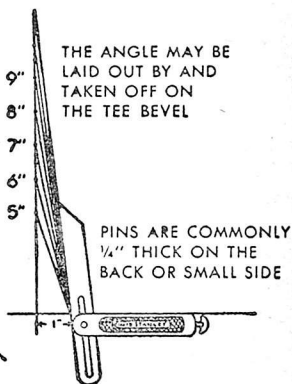
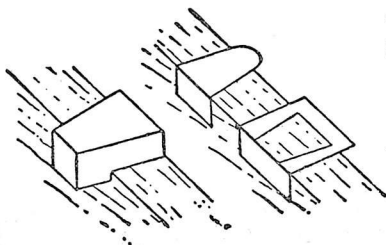
A lock or pin joint consists of a series of open mortises and tenons in line with one another. It is used principally in box construction.

LOCK OR PIN JOINT



Dovetail joints are difficult to make but they have great strength because of the flaring shapes of the sides of the pins

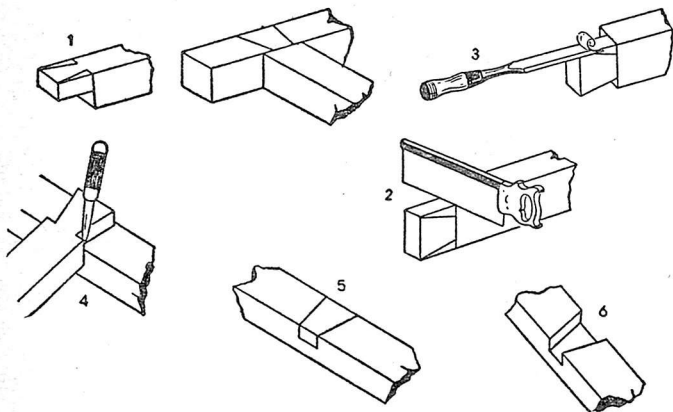
DOVETAIL ANGLES MAY BE LAID OUT WITH TEMPLATES



HOW TO WORK WITH TOOLS AND WOOD

and the dovetails. The projections on the members where the flare is seen on the ends are called pins and the spaces between them the sockets or mortises. The projections on the pieces where the flare is seen on the faces are called dovetails and the spaces between them the sockets or mortises.

The angle of the dovetails should not be too great or the joint will be weak because of the short gain at the corners. The angle may be laid out by squaring a line from the edge of a board measuring five, six, seven, eight or nine inches along it from the edge, then measuring one inch from the line along the edge and connecting the points. The angle selected may be transferred to the work with a tee-bevel or a template made of wood or brass.



Half-lap dovetail joint

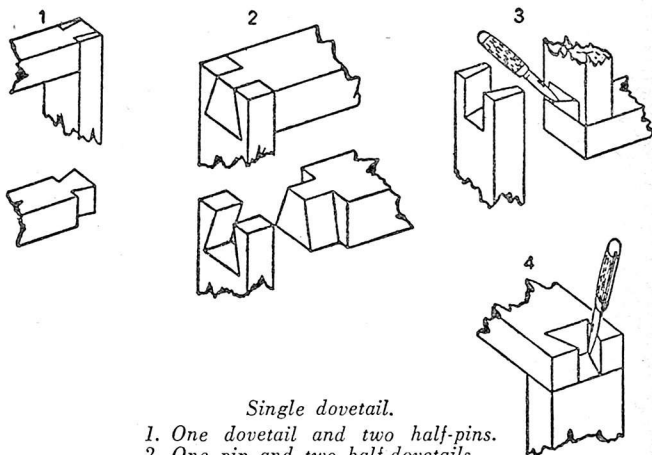
1. Mark dovetail.
2. Saw shoulders.
3. Chisel dovetail.
4. Lay dovetail on second piece and mark.
5. Square down edges and gauge depth.
6. Cut the socket in the same way as a half-lap notch.

MORE ABOUT PUTTING THE PIECES TOGETHER

The strongest dovetails are those in which the pins and the dovetails are the same size, although for appearance sake the dovetails are usually made larger but not greater than four times the width of the pins.

While the thickness of the pin and the width of the dovetails may vary according to the size and nature of the work, it is good practice to make the pin or its corresponding socket on the dovetail piece about a quarter of an inch thick on its narrow side. Mark the lines with great care. Use a well sharpened knife in laying out this joint.

There are several kinds of dovetail joints.



Single dovetail.

1. One dovetail and two half-pins.
2. One pin and two half-dovetails.
3. Marking dovetail from pins.
4. Marking pin from dovetail.

The half-lap dovetail is made by laying out the dovetail members like an end half-lap joint. The angle of the dovetail is then marked. The shoulders are sawed and the sides are pared with a chisel. The dovetail is then placed on the second member and the shape marked with a knife or very sharp hard pencil. These lines are squared down the edges and the

HOW TO WORK WITH TOOLS AND WOOD

depth of the notch is gauged. The sides are sawed and the waste wood chiseled to the bottom line, as in a middle half-lap joint.

A single dovetail may be made in the form of two half-pins and a whole dovetail, or as a whole pin fitting into a socket between two half-dovetails.

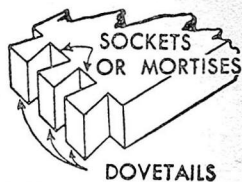
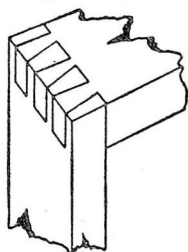
The thickness of each piece of wood is measured on the other piece from the end, to locate the shoulder lines. In the first form the pins are laid out and cut first. The sides are sawed with a back saw or a dovetail saw and the waste removed to the shoulder line with a chisel. This piece is then held on the other member in order to make the shape of the dovetail. These marks are squared across the end and the angles reproduced on the other side. The sides and shoulders are then sawed. In the second form the socket between the two half-dovetails is first marked and cut. The pin is then laid out from it and cut.

A through multiple dovetail joint is a series of single dovetails.

Whether the pins or the sockets should be laid out first depends upon the choice of the woodworker. In any event, the shoulder lines are squared first, the distance being determined by the thickness of the corresponding pieces. To lay out the pins, the width of the wood is divided into as many equal parts as there are pins, counting the two outer half-pins

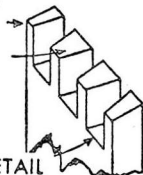
-
1. *Mark the thickness of one piece on the other and square a shoulder line.*
 2. *Divide width into as many parts as dovetails and measure half thickness of pins from each edge and each side of divisions.*
 3. *Square divisions to end, mark slant with bevel and square on the other side. This may also be done with a template.*
 4. *Saw sides of pins.*
 5. *Chisel bottoms of sockets.*
 6. *Mark dovetails from pins with a knife or awl; cut in same way as pins.*

MORE ABOUT PUTTING THE PIECES TOGETHER

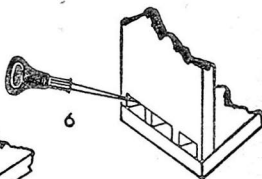
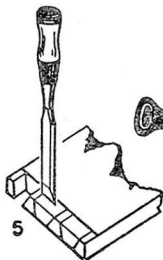
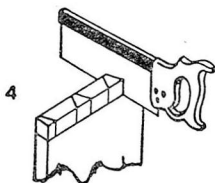
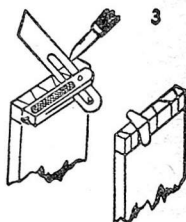
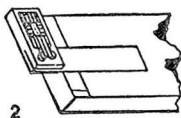
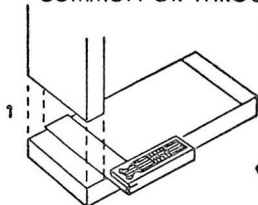


HALF PINS

PINS

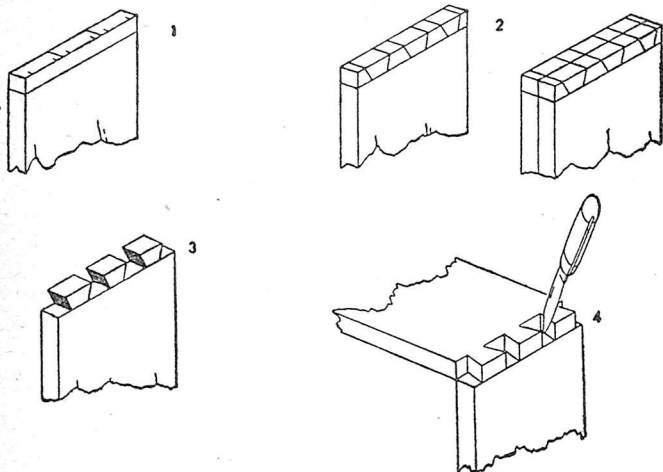


COMMON OR THROUGH MULTIPLE DOVETAIL
MORTISES OR SOCKETS



HOW TO WORK WITH TOOLS AND WOOD

as one. Sometimes half of the thickness of a pin is laid off first from each edge on the shoulder line and the intervening space divided. This gives extra strength to the outer half-pin. Half the narrow thickness of a pin, usually $1/8''$, is now marked on each side of each point and also from each edge. On these points, lines are squared to the end. The angles are then marked with the tee-bevel or with a template and the lines squared down the other side to the shoulder line. The waste wood is marked to avoid mistakes. The sides are sawed and the waste wood removed with a chisel. The pins are held over the other piece, matching the shoulder line. The dovetails and sockets are then laid out. The waste wood is marked and the sockets are sawed and chiseled.



1. Divide into as many parts as dovetails each side and from edges. Measure one-half width of pins. Square shoulder lines.
2. Square line on end and mark sides of dovetail with bevel or template.
3. Cut dovetails with saw and chisel.
4. Pins may be easily marked with knife or an awl.

MORE ABOUT PUTTING THE PIECES TOGETHER

If careful work has been done throughout, the parts should slip together tightly, making a snug fit.

In marking and cutting the sockets first, several pieces on which the dovetails are to be made may be clamped together and marked and cut at the same time. The shoulder lines are squared and divided into as many equal parts as there are to be dovetails. Half of a socket is then marked on each side of the dots and from each edge. Provision may be made for a wider socket on the outside as described for pins. The angles are now marked with the template or the tee-bevel, and the lines are squared across the ends and the angles.

The pieces are taken apart, the shoulder lines finished on the inner faces, marked on the other side. The sides are sawed on the waste wood. The waste wood is removed with a chisel. The pieces to be cut with pins are held singly in the vise, while the dovetail and socket member is held on the end of each and the shape of the pins scribed. The lines are continued down each face to the shoulder lines with the try square. The sides are now sawed and the waste wood between the pins removed with the chisel.

The half-blind dovetail is used in the fronts of drawers. This joint is illustrated on page 104. It is like the multiple dovetail except that the dovetails do not come through. Only the ends of the pins are seen on the side of the joint. The sides of drawers are thinner than the fronts. The gauge is set the thickness of the side piece, and a shoulder line is marked on the end of the front piece of the drawer from the work face to mark the overlap of the dovetails. The shoulder line on the face of the front piece and the shoulder line for the dovetails on the side piece may be made with the try square or with the gauge with a single setting. The pins and the sockets are laid out in the same manner as described before, either the pins or the dovetails first. I like to lay out the dovetails first. The sides of the pins can only be partly sawed, as the cuts extend only part way through the wood.

A rabbet is a recess cut out of the edge of a piece of wood. The bottom is parallel to the face, and the side is parallel to

HOW TO WORK WITH TOOLS AND WOOD

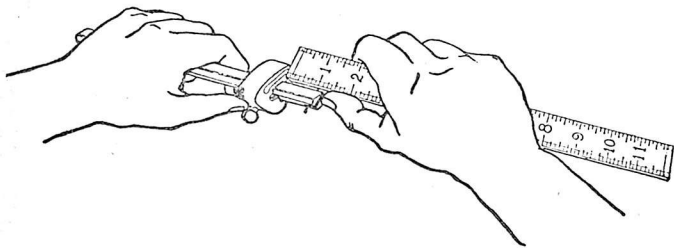
the end or edge, thereby forming a re-entrant square corner for another piece.

A rabbet joint is a square edge or end fitting into a rabbet, two rabbeted edges fitting into each other, or two adjoining rabbets with a spline fitting into them.

A rabbet on the end of a piece of wood is laid out by squaring a line for the side or shoulder across the face and down the edges. This should be as far from the end as the thickness of the joining piece. The depth is then gauged from the "work face," and lines marked on the two edges and on the end. It may be cut out with a back saw, or the shoulder may be sawed and the bottom cut with a chisel. A rabbet plane will also do this work. A spur is provided for cutting across the grain of the wood.

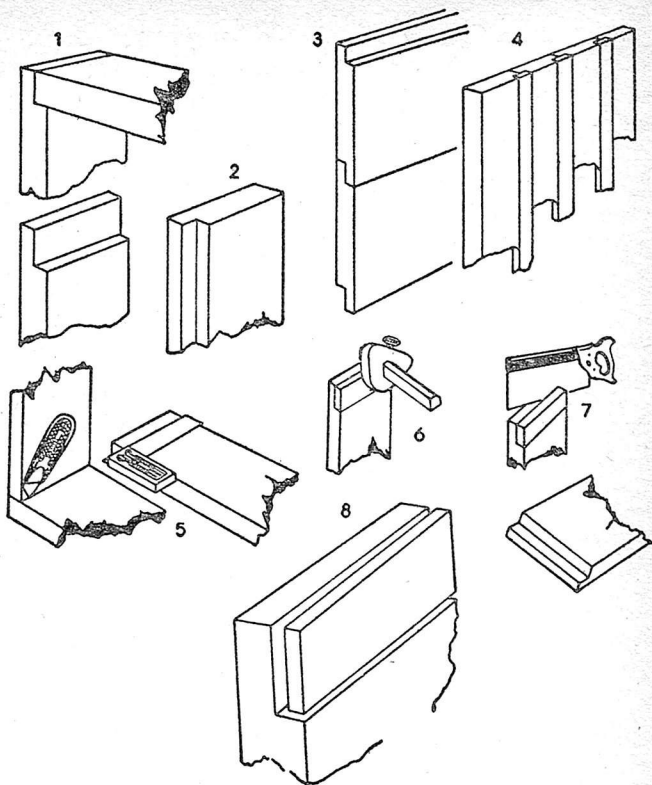
A rabbet on the edge may be cut with a rabbet or fillister plane or with a combination plane. The depth gauge and the fence regulate the depth and the width of the cut. Wide and deep rabbets may be cut by plowing grooves, one from the face and one from the edge. The thin strip which remains can be cut out with a chisel.

A dado is the groove cut across the grain of a piece of wood into which a second piece is fitted. It is known as a housed joint when the entire end of a second piece fits in the dado. Another form of this joint is the stopped or gained dado, in which the dado does not extend entirely across the



Set the gauge from a rule in order to insure accuracy.

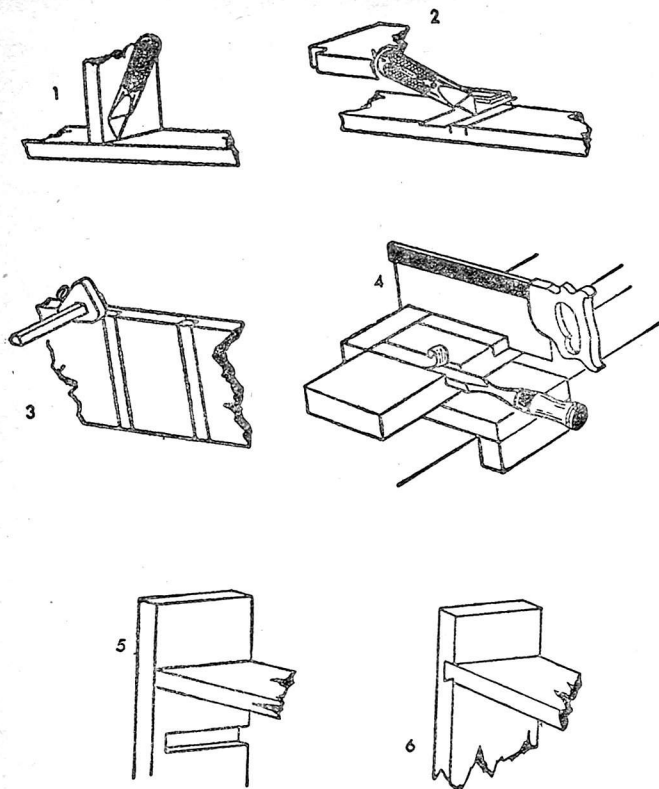
MORE ABOUT PUTTING THE PIECES TOGETHER



Rabbet joints.

1. Rabbet on end.
2. Rabbet on edge.
3. Ship lap.
4. Rabbet and fillet.
5. Mark thickness of one member and square line for shoulder.
6. Gauge depth of rabbet.
7. Saw on waste wood side of lines and finish with a chisel.
8. A wide or deep rabbet may be cut by plowing two grooves.

HOW TO WORK WITH TOOLS AND WOOD



DADO JOINTS

1. Mark width of dado.
2. Square lines on face and edges for shoulders.
3. Gauge depth of dado.
4. Saw on waste wood side of shoulder lines. Chisel out waste wood to gauge lines and uniform depth.
5. Stopped dado or gain.
6. Dovetail dado.

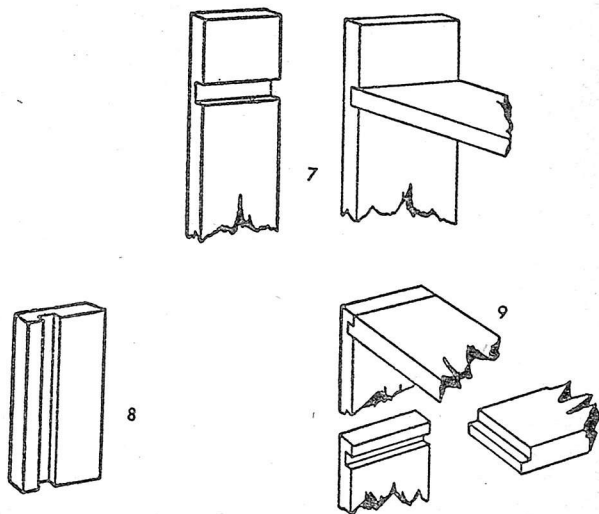
MORE ABOUT PUTTING THE PIECES TOGETHER

face of the work. Besides these are the shoulder housed or dado and rabbet and the dovetailed dado.

To lay out a plain dado, the piece to be housed in is set on the piece in which the dado is to be cut and the width of the dado marked. Lines are then squared across the face of the work through these points and down on both edges. The depth of the dado is then marked with the gauge. The sides may be sawed with or without the aid of a batten tacked on the face of the work corresponding with the line. The waste wood may be removed with a chisel or a router.

Dadoes may also be cut with a dado plane running against a batten tacked on the face of the wood. This plane has two spurs to score the sides of the dado ahead of the cutter. The blade has a skew edge to cut smoothly across the grain, and a depth gauge regulates the depth of the cut.

The stopped dado is laid out in the same way as the plain



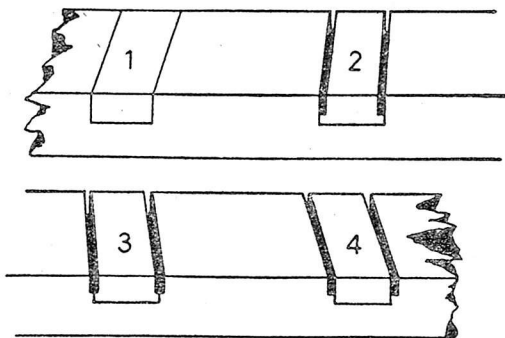
7. Housed joint. 8. Groove.
9. Shoulder housed or rabbet and dado joint.

HOW TO WORK WITH TOOLS AND WOOD

dado, but it does not extend across the full width of the piece. The depth is marked on one edge only, preferably the "work edge." The housed piece has a shoulder, marked and cut in one corner as long as the depth of the gain. In cutting a stopped dado, a small part at the inner end is cut with a chisel to regulate the depth and to help in sawing the sides with the back saw. The bottom is removed with a chisel or router. The sawing and chiseling may be done alternately, a little at a time, in order to avoid cutting the inner part too deep. The depth may be tested with a rule or with a nail driven into a stick.

A dado and rabbet joint is made in the same manner as a plain dado except that a rabbet is first laid out and cut on the end of the housed piece. This joint is frequently used for the corners of boxes.

Now you have a good picture of most of the common joints and also the story of how to make them. If you can make a board square and true, if you have learned how to use your chisel, and have before you the various joints, there is nothing in the making of furniture and things around the

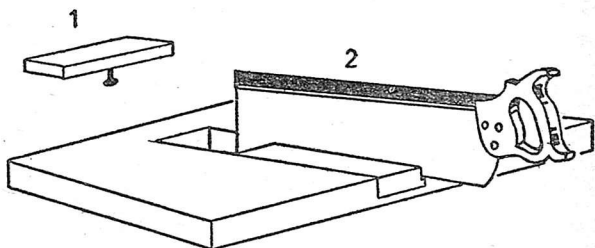


1. Groove or dado marked out.
2. Correct—Sawed on waste side between lines.
3 and 4. Incorrect—Groove made too large.

MORE ABOUT PUTTING THE PIECES TOGETHER

house that you cannot undertake with the greatest confidence in the world.

Cut with the grain. Mark sharply and accurately with the point of a knife and a marking gauge. Keep your tools sharp. Do a little bit at a time. Nothing should be too much for you.



1. A nail in a stick may be used as a depth gauge.

2. In cutting a stopped dado a small part at the inner end is cut with a chisel first to aid in sawing the rest of the shoulders.

In proceeding as far as this of course you must get acquainted with hot glue, because it is stronger and is conceded to be the most satisfactory.

You must also become acquainted with the various kinds of clamps which are used to make the glue effective.

The first important step is to have a clean glue pot. If possible use an iron double boiler, preferably with porcelain lining. An ordinary double boiler or even a tin can set in a pan of water may be used.

An electric glue pot is perhaps the best of all, for there is no danger of the glue getting too hot.

Break in pieces as much glue as you expect to need the following day and soak it in water for about twelve hours. Mix only a small quantity at a time, as it is much better to mix it fresh as required. Have sufficient water to cover the glue, and when it has softened properly, heat it to about

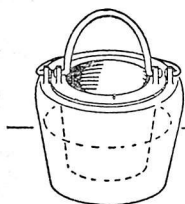
HOW TO WORK WITH TOOLS AND WOOD

130 to 150 degrees, but be careful not to boil it. Boiling will weaken it, as will adding water to thin it out after it is first soaked and heated.

When the glue has melted, it should run from the brush in a stream slightly thicker than milk. To prevent evaporation the heat should be shut off when the glue is not in use.

Almost any kind of brush may be used for spreading glue—one either of bristle, wire, or shredded rattan. It is well to keep a small wooden paddle in the glue pot for stirring

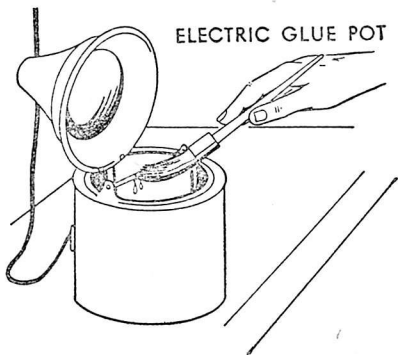
IRON GLUE POT



HOME SUBSTITUTES



ELECTRIC GLUE POT



MORE ABOUT PUTTING THE PIECES TOGETHER

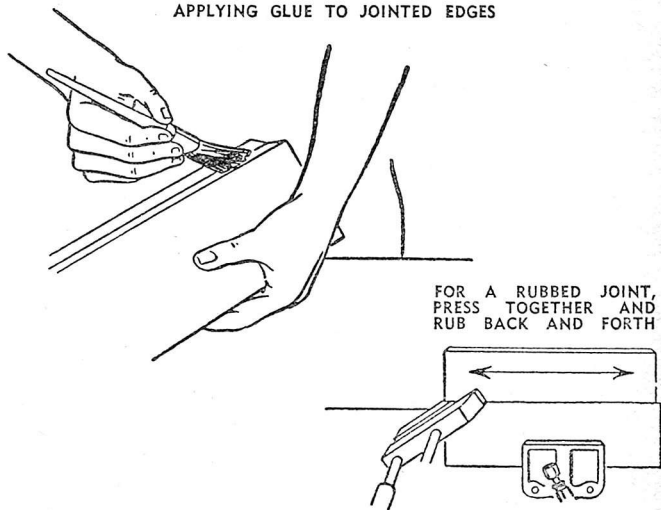
and also for wiping the brush on, instead of on the edge of the pot. The paddle can be used for spreading the glue, particularly for working into holes and crevices.

Animal glue is used hot. Fish and vegetable glues are usually liquid glues used cold. Hot glue may be made into a slow setting cold, or liquid glue, by adding either nitric, hydrochloric, or oxalic acid to it.

Hot glue will become practically waterproof or insoluble after drying, if about .01 of potassium bichromate is added while the mixture is hot.

Before using hot glue be very particular to have everything in readiness. Have the work and clamps handily arranged for quick use. Put the pieces together that are to be glued, see that they fit and will quickly go together when the glue is applied. Warm the joints so the glue will penetrate into the wood.

APPLYING GLUE TO JOINTED EDGES



HOW TO WORK WITH TOOLS AND WOOD

When all is ready apply the glue either with a brush or a paddle.

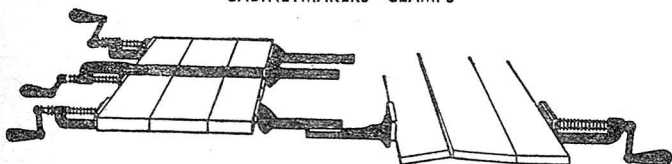
Work quickly, for if the glue chills before the work is finished, it will not hold. Afterwards draw the joints tight with clamps. Test the corners with a try square and adjust the clamps until the corners are true.

Glue does not hold as a cement between two surfaces, but penetrates the wood while in a liquid state. After it hardens, hundreds of small keys reach out between the wood fibers and join the two pieces of wood firmly together.

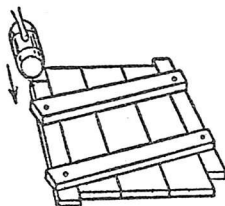
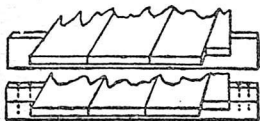
Wherever possible divide the work into small units for gluing, for it will greatly aid in getting the clamps on quickly and in truing the joints. For example, it would be very difficult to glue together the four sides and legs of a small table in one operation and have all sides true and the joints drawn in place before the glue chills.

Common practice is to divide the work into three opera-

CABINETMAKERS' CLAMPS

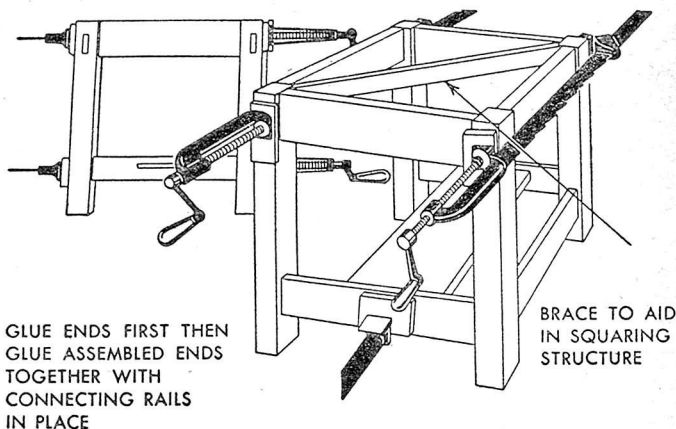
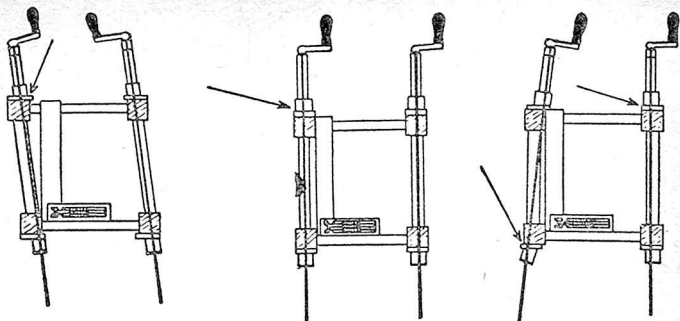


AVOID DRAWING TOO TIGHT



CLAMPING WITH
WEDGES, CLEATS AND CRAMPS

MORE ABOUT PUTTING THE PIECES TOGETHER



tions. Glue one end or side, two legs and the intervening rail and stretcher. Then glue the opposite end or side in the same manner. When the glue is hard, remove the clamps, spread glue on the joints, insert the rails and stretchers, and join the two ends, tightly clamped and true.

Long-edged joints, when glued, are put together either by being rubbed or squeezed together by clamps. Before rubbing, the edges should be carefully planed with a jointer plane and the two pieces of wood matched for figure and

HOW TO WORK WITH TOOLS AND WOOD

grain. When the two edges match throughout their length and no cracks show on either side, the glue may be spread. With a hand screw or a piece of wood clamped on as a guide, press down on the upper board and rub back and forth until the glue begins to set. This will be the signal to stop rubbing and the work may be carefully placed away to dry.

Squeezed joints are usually left very slightly open in the center. This slight crack will be closed by the clamps. The greater pressure on the ends will counteract the tendency of long edge joints to open on the end.

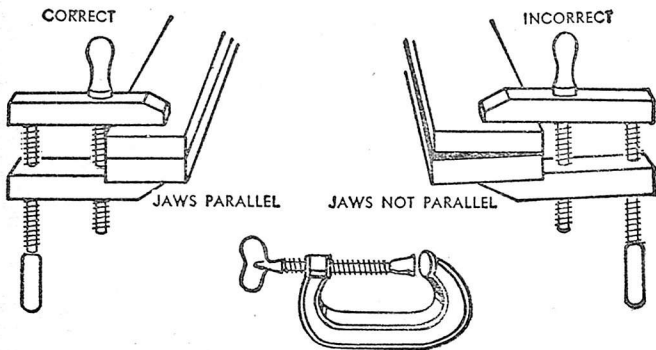
There are many forms of clamps and devices for holding work firmly in place until the glue sets: cabinetmakers' clamps, carriagemakers' clamps, hand screws, vises, wedges, cramps and tourniquets of string or rope.

Good cold water glues are also now available, such as casein glue and resin glues, the latter being waterproof and therefore excellent for all marine work.

There are many commercial liquid glues, too, that may be used for minor quick repairs.

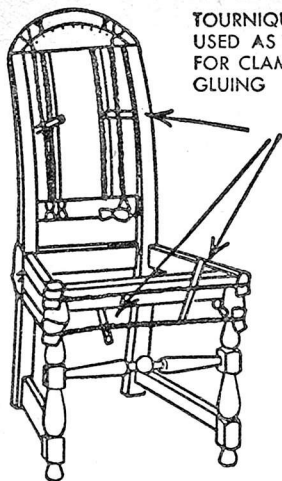
Shellac, while not a glue, is very useful for sticking paper, rubber, felt, glass, etc., to wood.

WOOD HAND-SCREWS



CARRIAGE MAKERS C CLAMP

MORE ABOUT PUTTING THE PIECES TOGETHER

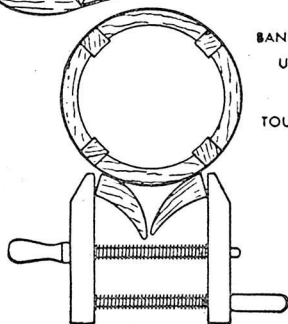


TOURNIQUETS
USED AS A SUBSTITUTE
FOR CLAMPS IN
GLUING

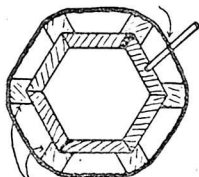
AN IRREGULAR SHAPE,
WOUND WITH CORD AND WEDGED
WHILE GLUING REPAIR JOB



BAND CLAMP OR STEEL STRAP WITH HORNS TO DRAW
UP CIRCULAR AND OVAL WORK WHEN GLUING



TOURNIQUET FOR CIRCULAR OR POLYGONAL WORK



PROTECTING BLOCKS

CHAPTER TEN

Some Fancy Touches

INVARIABLY when a man or a boy has in his hand a good, sharp pocketknife or chisel he'll go looking for a piece of wood to cut and pare into interesting shapes and designs.

If you think back you will remember how you cut notches in a stick and finally carved your initials wherever you found a willing piece of board. It is in that first wood carving that most of us learn something about the grain of wood and discover that only the sharpest point or edge will really cut across the grain and enable us to get the effect we are after.

Far better than a pocketknife for carving are the regular woodcarver's tools. Most of the remarkable carving is, of course, completely impossible without these special tools, although for the decoration of the upright pieces of the bookrack, described in Chapter Four, the ordinary tools in your kit would do.

In the same way most of the special shapes which you wish to give to particular pieces in a bookcase, a kitchen cabinet, or the panels of a door can be produced by the ordinary tools of the kit but are much easier and much quicker to produce by the use of that remarkable tool known as the combination plane. This is the device which is used by the cabinetmaker for so much of his work, enabling him to produce flutes, beads, reeds, rounded corners, and finishing touches of almost

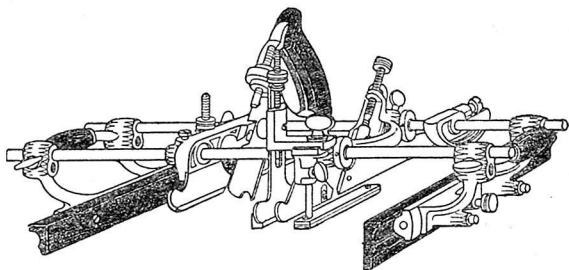
SOME FANCY TOUCHES

every type. It is really astonishing how much of the work of cabinetmaking can be done with such a device.

Not only does the combination plane cut these various decorative pieces of wood just as you want them, but it also does a great deal of the work for which the amateur ordinarily has to depend upon the saw and chisel. This type of plane is equipped with a large number of cutters of various shapes which can turn out rabbets, dadoes, fillisters and other cuts with which the ambitious amateur puts together his pieces of wood to produce the finished article.

There is another peculiar thing about the combination plane: the bigger and more complete machine is of greater importance to the amateur than it is to the professional craftsman because the amateur rarely makes more than one thing of a kind and his interest in his work and his desire to produce many different kinds of objects mean that he really has use for the complete machine.

A large combination plane is practically a finishing mill in itself and of course makes possible work that you could not hope to accomplish otherwise. It is also a source of saving in time and labor when you have immediate need of a small



"Fifty-Five" Plane

HOW TO WORK WITH TOOLS AND WOOD

piece of molding and it is inconvenient or expensive to go to the mill and have it made.

Perhaps the easiest way to understand, without actually seeing such a machine or beginning its use, is to look at the sketch on the next page of the various cutters which are furnished with one of these big planes and to look at the names of the cutters themselves. They give you a splendid idea of just what the device will do.

Forty-one additional cutters are carried in stock by the manufacturer, Stanley Tools, New Britain, Conn., providing a variety of other sizes of many of the cutters furnished with the plane.

Complete instructions for the operation of the plane and its various attachments and cutters are packed with all tools of this type when you buy them.

These planes by themselves overcome many of the difficulties of cutting wood just exactly the way you want to cut it. A guide or fence can be set to insure that your cut is exactly the required distance from the edge of the board. A depth gauge can be set to prevent you from cutting any deeper than you wish to cut. Even more interesting is the fact that these planes cut beautifully across the grain, as in making a dado. Little spurs, sharp and knifelike, adjustable, of course, precede the main cutting blade and score or cut the fibres of the wood on both sides of the cut, which is made by the blade following along behind.

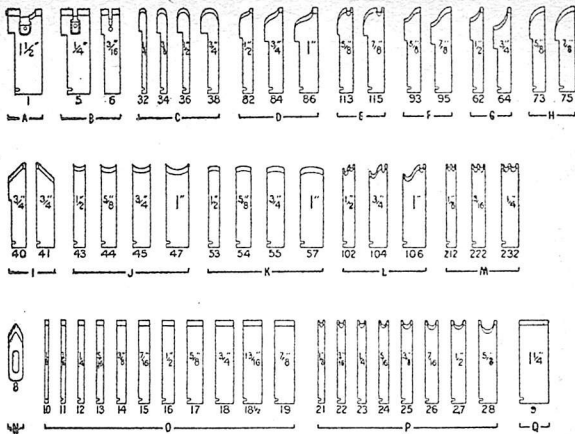
Of course there are other planes besides the combination plane which do the individual jobs.

There is the circular plane, the rabbet and fillister plane, the router plane, the match plane, and the various spoke-shaves.

It is astonishing to see how these various hand machines have been developed to produce those parts of the amateur's daily work in his little shop which are the most difficult.

When it comes to actual carving there is no machine which will do it for you. There is no substitute for steadiness of hand

SOME FANCY TOUCHES



The names of these cutters are as follows:

A	1 Sash Cutter	1 1/2"
B	2 Match Cutters	1/4" and 3/16"
C	4 Fluting Cutters	3/2" to 3/4"
D	3 Reverse Ogees Cutters	1/2", 3/4" and 1"
E	2 Quarter Rounds with Beads	5/8" and 7/8"
F	2 Roman Ogees Cutters	5/8" and 7/8"
G	2 Quarter Hollow Cutters	1/2" and 3/4"
H	2 Quarter Rounds Cutters	5/8" and 7/8"
I	2 Chamfer Cutters	1 Right and 1 Left
J	4 Hollow Cutters	1/2" to 1"
K	4 Round Cutters	1/2" to 1"
L	3 Grecian Ogees Cutters	1/2", 3/4" and 1"
M	3 Reeding Cutters	1/8" to 1/4"
N	1 Slitting Cutter	
O	11 Plow and Dado Cutters	1/8" to 7/8"
P	8 Beading Cutters	1/8" to 5/8"
Q	1 Fillister Cutter	1 1/4"

HOW TO WORK WITH TOOLS AND WOOD

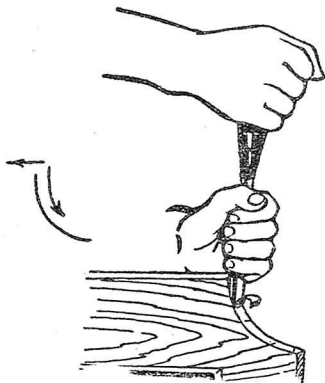
and eye, and long practice. Probably more tools have been designed for wood carving than for any other mechanical operation. Each of the tools is, of course, in the class of a chisel and the fundamental requirement of wood carving is to be able to use a chisel skillfully and successfully. The following paragraphs and drawings are a lesson in the proper use of the chisel.

In cutting with a chisel be very careful, especially when finishing, to make the shavings thin and to cut with the grain of the wood so the surface will be left smooth and bright.

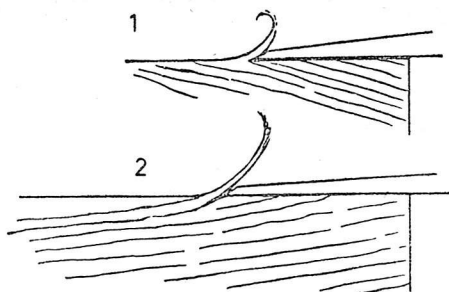
Hold the chisel, when possible, at a slight angle to the cut, instead of straight. This gives a paring or sliding cut that is easier to make, and one that leaves the work smoother both on the end grain and with the grain.

A chisel is frequently used for roughing, but in cutting curves on ends, corners, and edges, both convex and concave, it is better to remove as much waste as possible with a saw.

The two principal chisel cuts are vertical and horizontal paring. Always chisel from the line toward the waste wood,



A concave curve may be cut by pressing down on the chisel and at the same time drawing back on the handle. Observe the grain.

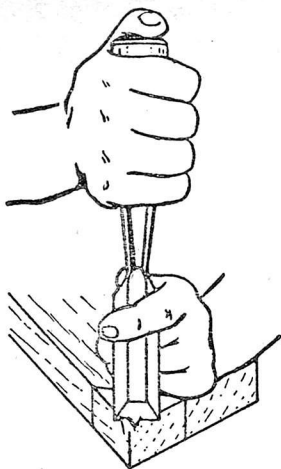
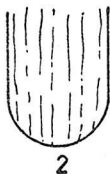
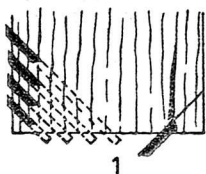


1. Cutting with the grain the fibers are severed, leaving the wood smooth.
2. Cutting against the grain leaves the wood rough. The chisel acts like a wedge, cutting and forcing the fibers apart in advance of the cutting edge. The cut cannot be controlled.



The chisel cuts more easily and smoothly when slightly slanted in the direction of the cut. This is because the edge is minutely serrated or saw-toothed and because turning has the effect of decreasing the cutting angle of the bevel.

HOW TO WORK WITH TOOLS AND WOOD



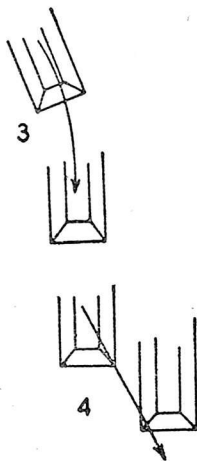
Vertical paring on corners and ends.

1. Observe the grain and start cutting at the edge to avoid splitting the wood.

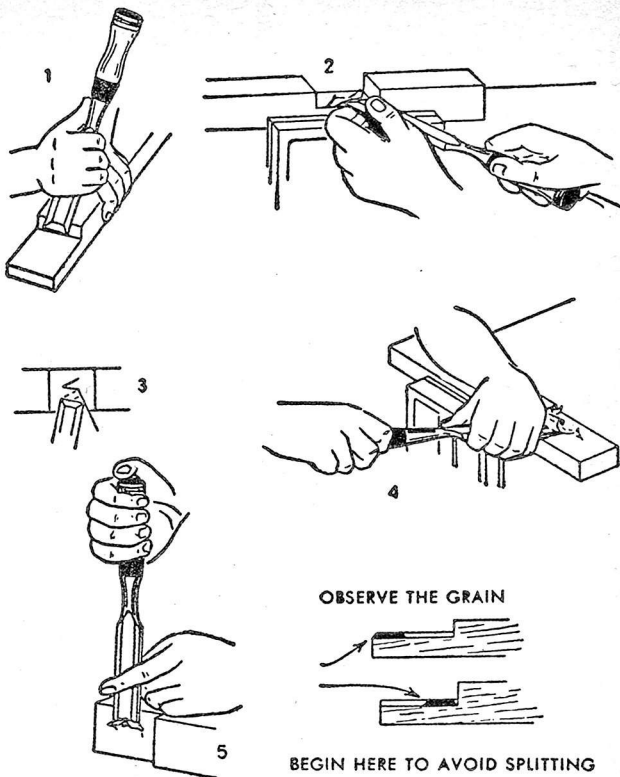
2. A round corner or end may be pared in the same way.

3. A shearing cut may be made by bringing the chisel from a slanting to a vertical position.

4. The chisel may also be slid to one side as it is pressed down.



SOME FANCY TOUCHES



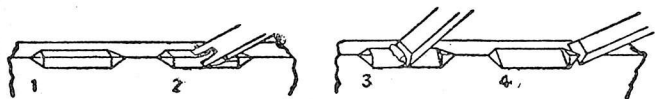
1. To pare a shoulder or to clean a corner, the chisel may be held vertically, then tipped so as to secure a shearing cut when the chisel is drawn toward the workman.
2. Flat or horizontal paring.
3. Take a shearing cut where possible. In close places the chisel may be moved this way.
4. Cut half from each side.
5. Vertical paring across the grain.

HOW TO WORK WITH TOOLS AND WOOD

and start in such a way that, if the wood should split, the split will be in the waste wood and not in the good wood.

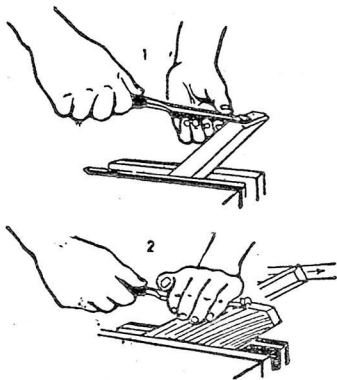
A coping saw may be used for curves in thin wood, a compass saw or a turning saw for curves in thick wood, and a back or crosscut saw for straight, oblique cuts. A chisel should then be used to finish the work.

A chisel may be used to cut a chamfer, a stop chamfer or a rabbet, but with a spokeshave or bull-nose rabbet plane the work may be easily and decidedly better done. The ends only need be cut with a chisel.



To chisel a stopped chamfer.

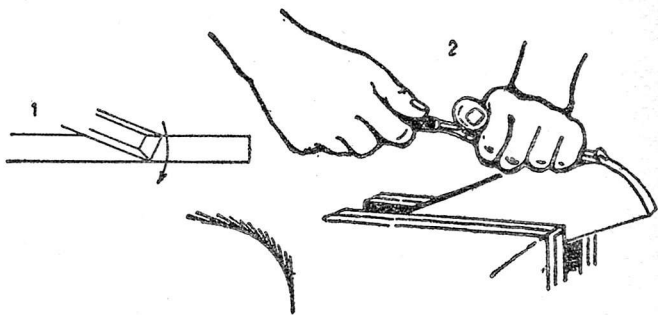
1. Lay-out.
2. Rough cutting with bevel down.
3. Finish cut. A shearing cut.
4. Cut the stops or ends last.



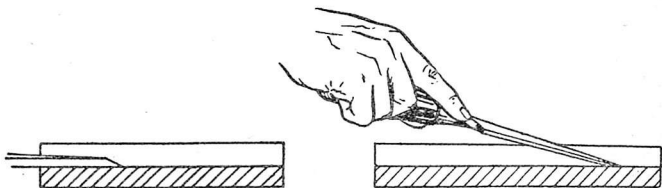
1. Paring a chamfer.
2. Paring a slanting edge or corner.

SOME FANCY TOUCHES

For straight and convex cuts the chisel must be held with the flat side on the work and the bevel up. The left hand holds the chisel, the right hand guides it, applies the power down on the wood and acts as a brake. On occasion an exception may be made to this method. When cutting a long groove or a dado in wide wood, the chisel may cut in too deeply. It should then be turned so the bevel is down; this will allow clearance for the handle.



1. A convex curve may be cut in this way.
2. Hold the chisel at all points tangent to the curve to avoid digging in side. Hold chisel sideways to secure a shearing cut.



When cutting a dado or a rabbet, the chisel is sometimes held bevel down. This gives clearance for handle and fingers.

HOW TO WORK WITH TOOLS AND WOOD

Gouges, of course, are also chisels, the most important difference being that they are rounded, giving them a curved cutting edge.

They are classed as firmer and paring gouges and furnished with either a flat, medium, or regular sweep from one-eighth to two inches wide.

Firmer gouges may be had with the bevel ground either in the inside or the outside and with tang or socket handle. They are used for cutting hollows and grooves.

Paring gouges are inside ground, that is, the bevel is on the inside, and have the tang handle. They may be had with offset handles.

Paring gouges are used to cut surfaces or ends needed to match in irregular forms as, for instance, moldings. Pattern-makers use these gouges to finish shaping core boxes and for similar work.

The wood carver's tools and gouges differ from the ordinary tools in that the sides, instead of being parallel, taper toward the shoulder and are beveled on both sides. In ordinary practice the gouges come with eleven different sweeps or curves, ranging from those that are almost flat to those of a deep U-shape.

A FIRMER GOUGE IS A CURVED CHISEL OUTSIDE GROUND



INSIDE GROUND

PARING GOUGES ARE INSIDE GROUND GOUGES
OF FLAT, MIDDLE AND REGULAR SWEEPS



SOME FANCY TOUCHES

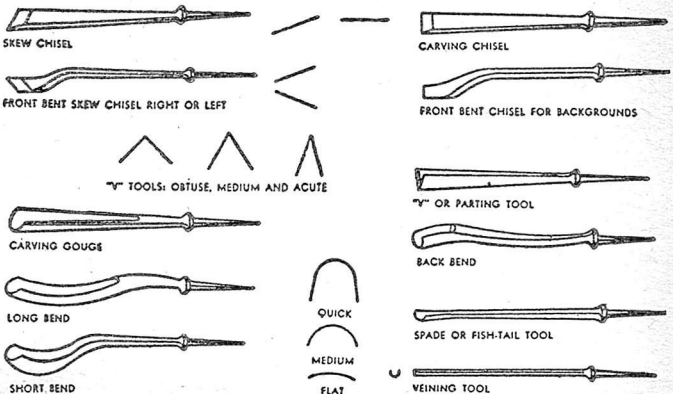
The small, deep, U-shaped gouges are called *veiners*. The larger ones with quick turns are called *fluters*. Those with a slight curve are called *flats*.

There are three V-shaped tools: acute, medium, and obtuse, called *V* or *parting* tools.

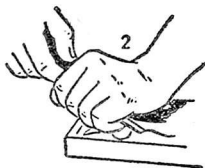
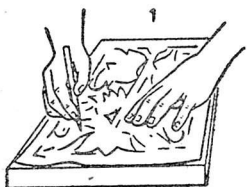
The chisels are square or oblique on the ends and are known as firmers and skew firmers. Skew firmers with bent shanks may be had either for right or left hand.

These various chisels are made in eighteen sizes, ranging from $1/32''$ to $1''$, with straight, long-bend, or short-bend shanks. Veiners are made as small as $1/64''$. The other tools are made in six sizes between $1''$ and $2''$. Most of the small sizes are shaped either spade or fishtail, which adds to their usefulness in modeling. A greater clearance is given just back of the cutting edge.

To carve a design in low relief, sketch or trace an outline of it on the wood. Go over the outline with a small gouge or a parting tool, and cut on the background side of the line. When doing this observe the direction of the grain on the raised part. Set down the outline with a chisel or gouge that conforms with the curve of the design, using a mallet for tapping. Cut down the background with a flat gouge. Model



HOW TO WORK WITH TOOLS AND WOOD



1. Trace design on wood or draw it geometrically if its character permits.
2. Outline with a gouge or veiner. Be sure to cut outline on background side of line.
3. Set down outline with a mallet and gouges of suitable sweeps, to fit the curves of the design.
4. Cut out background with a flat gouge. Model surface, add detail, clean up corners.

the surface of the design so as to have an even degree of finish. Complete modeling by putting in details and veining. Clean up the edges and the background. Stamp the background if a stamped texture is desired. Try to avoid undercutting the outline, or having the edges too sharp or the background too smooth.

Many beautiful yet simple designs on panels, bookracks, cabinets, or chests can easily be made by merely outlining with a small gouge or veiner. The effect may be improved by cutting or stamping down the background and still further by slightly modeling the raised parts. The gouge lends itself to the forming of beautiful units and borders by simply combining gouge cuts. The skew chisel and the carving knife are particularly adapted to the type of notching called chip carving. Chip carving is effective if not overdone and may be as simple or ornate as the taste of the carver demands.

Wood carving is the kind of thing that men spend a lifetime upon and is, of course, one of the great arts. There has been a great deal written upon the subject and anyone who wishes to go into it deeply should by all means go to the public library and find what books he can. He will indeed be amply repaid for his interest.

CHAPTER ELEVEN

Getting It Ready for Use

THERE ARE SO MANY WAYS of finishing a piece of wood that it seems to me that every time I get through making something and painting it, oiling, varnishing, or whatever, I wish I had another just like it so that I could try a different kind of finish to see how it would look. As a matter of fact an ordinary list of the various ways to preserve wood must include: paint, enamel, stain, French polish, varnish, wax polish, oil polish or lacquers.

Not so many years ago it was necessary for the workman to purchase the raw materials, such as oil pigment, turpentine, and various oxides for making up his paint. He even made up his own varnish. But those days are gone. The paint and varnish manufacturers make a great variety and they are far better than even the most skilled home workman could possibly hope to produce. Complete directions, of course, are always furnished with the prepared paints, varnishes, and stains, but not all the rules of good work are given. Before you paint anything, unless you are an old hand at it, it would be wise to read the tips which follow.

Paint: Here are some on painting outdoors after you have put a new rail on the porch stairs, or put a new piece of siding on the outside of a house, or perhaps even tackled a bigger job.

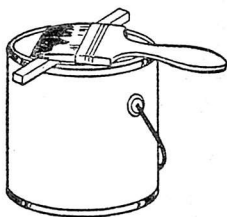
GETTING IT READY FOR USE

1. Do not fail to stir the paint thoroughly.
2. Do not paint in very cold or frosty weather.
3. Do not paint upon wet or moist surfaces, or dirty and greasy surfaces.
4. Shellac the knots to prevent the pitch or sap from coming through the paint.
5. Do not paint over blistered, loose, cracked, or peeling paint. Remove these imperfections.
6. Do not apply second or third coats until previous ones are dry.

THIS IS CARELESS
WILL DRIP PAINT



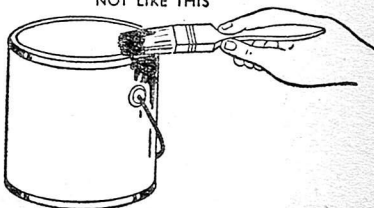
STICK OR WIRE FOR A REST
IS NEAT AND CLEAN



FLAP THE BRUSH AGAINST
THE INSIDE OF THE CAN LIKE THIS



NOT LIKE THIS



HOW TO WORK WITH TOOLS AND WOOD

7. Putty all holes after the first or priming coat.
8. Do not use cheap paint oils—use pure linseed oils.
9. Do not use old worn-out brushes and expect a good job.
10. Brush the paint in. Do not flow it on.
11. Do not prime with ocher or cheap paint.
12. Several thin coats are better than one thick coat.

Most of these points apply also to painting inside. The composition of the paint is a little bit different but the method of application is very much the same.

In painting walls, of course, it is usually necessary to size the plaster or surface upon which you are going to paint.

A size is a material which is painted on to a surface in order to leave upon that surface an impervious film through which the paint vehicle will not penetrate. For instance, a plaster wall will have a considerable amount of absorptive capacity for any liquid. Obviously, if this wall could be coated with an impervious film and hence the absorption of the paint lessened, the net result might be a saving in expense and an even color on the surface when dry.

Enamel: Enameling is really rather difficult but the results are worth a great deal of effort because a hard, durable coating can be had with enamel which nothing else will produce.

All enamels require undercoats to procure the proper foundation before applying the finish coat or coats. These undercoats dry with a flat finish. The use of an undercoat is necessary because the enamel is partly transparent. This condition of the enamel is due to its being made with the best light colored varnish so that a proper gloss and flow may be obtained.

The surface to be enameled is given one, two or more coats of undercoat, each of which should be lightly sanded. Then one to two coats of the enamel are applied as desired to obtain the finish required.

Stain: Stains are divided into many different classes. The most common ones are the water stains, the chemical stains, the spirit stains, the oil stains, and the varnish stains. There

GETTING IT READY FOR USE

are also on the market combination stains and fillers, that is to say, the wood is stained and filled at the same time.

Water stains are water-soluble dyes. These in some instances have a tendency to fade, although if care is taken in their selection trouble may not be encountered. Chemical stains may have no color of themselves, but have a chemical action upon the wood, thereby producing a color. For instance, ammonia is used to give wood an appearance of age, and to open the grain. Some stains penetrate more deeply and color more evenly when the wood has first been treated with ammonia. This ammonia treating is called "fuming" and is done by exposing the work to ammonia fumes in an air-tight box or room. The ammonia may be painted on in the same way as water stain. Another instance is bichromate of potash, which produces an old appearance on mahogany, chestnut, or walnut. The immediate effect is a yellow color but in time the action of the daylight and oiling changes it to brown.

Water and chemical stains on application have the effect of raising the grain of the wood, and therefore require sanding lightly before any further part of the finishing process is done. To bring this raising of the grain to a minimum, the wood is given an application of water with a sponge or brush. This, as it dries, raises the grain, which then can be sanded. Then an application of the stain is made which, after drying, may require a further very slight sanding.

Spirit stains are dyes dissolved in alcohol or naphtha.

Oil stains represent merely the solution of oil soluble materials in their respective vehicles, and the subsequent suspension of pigments in these vehicles.

Varnish stains are very similar to oil stains in that they are varnishes containing either oil soluble colors or merely pigments suspended in them, and they are used mainly where an attempt is made to save money by combining staining and varnishing.

Probably the method which produces the best results in wood finishing is that in which water or chemical stains are employed. They produce good colors which are sufficiently

HOW TO WORK WITH TOOLS AND WOOD

transparent so that the natural grain and beauty of the wood is apparent. Stains containing insoluble pigments are very apt to produce a cloudy or muddy effect, thereby partially covering up the grain of the wood.

In staining wood in the case of water, spirit and oil stains apply the stain freely and quickly with a sponge, rag, or brush, working with the grain. Work in such a manner as to avoid overlapping edges. Considerable care must be exercised in applying water stains, as the work must be done quickly and evenly.

Oil stains are probably the easiest stains to handle.

With the exception of varnish and chemical stains, as the color begins to dry, rub off with a soft rag any surplus stain not absorbed by the wood. This will prevent the grain becoming obscured or clouded. This applies especially to oil stains and to a combined stain and filler. Cover the surface well, but do not apply the stain too lavishly.

A great many of the woods have large open pores and require filling in order to get an even final result. Oak, for instance, which has been varnished but has not been filled will not have a satisfactorily smooth finish because of the varying porosity of wood. These fillers are made in different shades for different woods. They are sold in paste form to be thinned down with turpentine.

The filler should be of the consistency of a varnish and applied with a good brush, rubbed well into the grain and pores of the wood. When the filler is fairly well set, which is when it begins to show flat, rub off the excess from the surface of the wood with a cloth or burlap pad, always rubbing across the grain. Be sure no streaks are left on the surface and no surplus filler left in the corners.

Only fill as much surface at a time as can be wiped off before it sets too hard to rub off without rolling up.

All rubbing or wiping must be done across the grain.

When the filler is thoroughly dry, go over with No. 0 sandpaper and proceed with finishing as desired.

Shellac may be used to make the final finish on top of stain.

GETTING IT READY FOR USE

It dries very quickly and is very hard but will not stand up under moisture. It is used frequently as a liquid filler underneath varnish or wax polish.

After the wood has been filled and filler has thoroughly dried it should be sandpapered very lightly and a thin coat of shellac should be applied. Shellac sets quickly and does not "level up." When you put it on you must do it quickly with long, even strokes. If you omit a single spot your coating fails because you cannot go back afterwards and touch it up the way you can with paint.

One of the simplest and most successful finishes for things you make around the house is a coat of stain followed by several coats of shellac, each rubbed with fine sandpaper, and then a rubbing of wax.

French Polish: The French polish finish is the finest shellac finish that there is. It takes time and care to produce it.

The wood must be made perfectly smooth, then filled and again smoothed. To bring out the grain it is sometimes oiled. Two or three coats of shellac are applied and rubbed down with No. 00 sandpaper. This forms a body on which to work and prevents the oil from being absorbed by the wood.

Prepare three wads of clean cotton waste and three pieces of clean, soft muslin, free from lint or sizing, in which to wrap them. An old linen handkerchief is good to use. Dip one of the wads in shellac, just enough so that it will squeeze out readily, then wrap it in the cover. The polishing consists of rubbing on the shellac with a circular motion. Do not allow the pad to rest on the work at any time. After the shellac has been applied and is dry, dust a little pumice on the work and also sprinkle on a few drops of linseed oil. Now use the second rubber, continuing the circular motion and rub until the work presents an even dull surface and then wipe it clean. Continue this three or four times, allowing sufficient time for the work to dry after each rubbing. Finally with a very little alcohol on the third rubber, go over the work quickly and wipe off the polishing marks. Do not have too much al-

HOW TO WORK WITH TOOLS AND WOOD

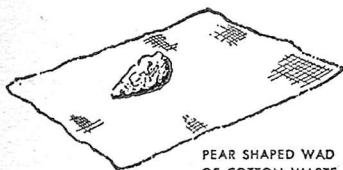
cohol on the rubber, and be careful not to let it stop on the work, or a dull burned spot will show.

As the rubbers are said to improve with age, they should be kept in separate, tightly covered bottles to keep them soft. In any case, the muslin cover should be washed in strong borax, then rinsed and dried.

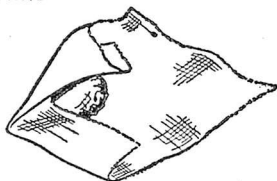
Varnish: The varnish finishes are easier to produce. The wood, of course, must be filled and then shellacked when it is ready for a light sandpapering for finishing. The usual varnish finish consists of one or two coats of rubbing varnish followed by a coat of finishing materials.

There are numerous varnishes used in finishing, both for cabinetwork and also for use in the home. In varnishing, it is necessary for good work to have the varnish at a temperature of about 65 to 70 degrees F.

FRENCH POLISHING



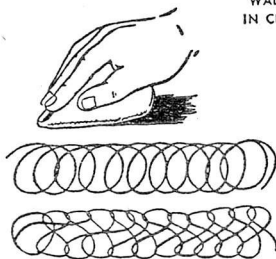
PEAR SHAPED WAD
OF COTTON WASTE



WAD WRAPPED
IN CHEESECLOTH



CORRECT SHAPE
FOR POLISHING RUBBER



CORRECT MOTIONS FOR RUBBER



INCORRECT SHAPE
FOR POLISHING RUBBER



INCORRECT MOTION

GETTING IT READY FOR USE

Varnish should be applied with a good grade brush, perfectly clean. A brush used for varnish should not be used in paint, enamel, or other mixtures.

If varnish is to be applied on floors, a good grade floor varnish should be used. This varnish also may be used for a window trim and doors, although special varnishes are made for this work.

In cabinet or wood work, it is necessary to have a rubbing varnish in order to build up a smooth surface before applying the finishing varnishes, which generally contain more oils and require a longer time to dry.

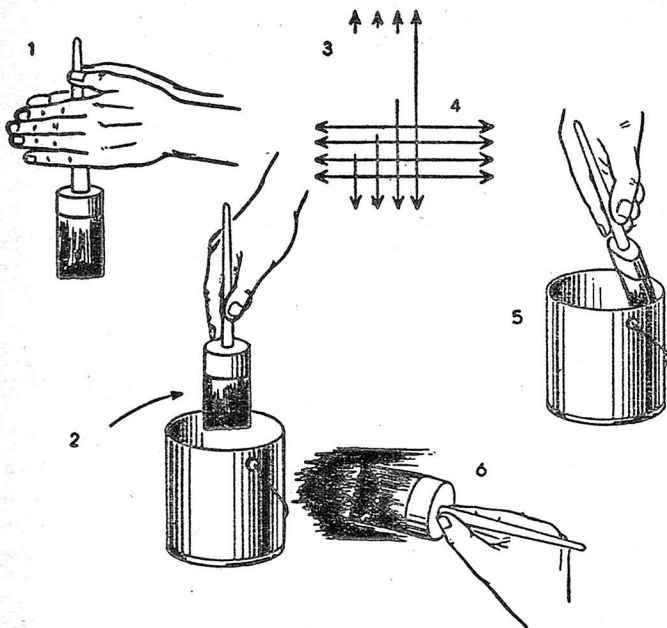
The time required between all these coats varies with the stains, fillers, and varnishes used, but never should be under twenty-four hours and preferably longer. Each coat must be thoroughly dry before the next coat is applied.

After applying the rubbing varnish and allowing it to dry, it is rubbed with a felt pad moistened in water and pumice stone to a smooth finish, being careful not to rub through the coat of varnish. Rubbing should always be done in the direction of the grain, not with a circular motion. Do not rub part of work on same panel in different directions.

The work is now washed off with a sponge and water, making sure to leave none of the pumice. It is then dried with a chamois skin and allowed to dry thoroughly before applying the next coat of varnish. If it is desired to leave the work in the rubbed effect, it may be done either now or after applying the second coat of rubbing varnish, and proceeding as before. If a gloss effect is desired, a finishing varnish is applied and allowed to dry thoroughly.

On certain work where the varnish film has extremely hard usage such as on floors, it has been definitely proven that a coat of shellac after the filler is injurious. The shellac coat is extremely brittle and when a flexible film of varnish is applied over this and this varnish film receives extremely hard service, the shellac coating causes the varnish coat to become loosened from the wood surface. Therefore varnish should not be applied on floors over shellac.

HOW TO WORK WITH TOOLS AND WOOD



VARNISHING

1. Before using, twirl brush between the hands to remove oil or turpentine.
2. Raise the brush from the can like this.
3. Stroke up and down.
4. Then stroke across.
5. Draw surplus varnish from the brush on the inside of the can.
6. Give finishing strokes lightly.

GETTING IT READY FOR USE

Polishing: Rubbing and polishing are important branches of finishing. It is here that the final touches are often added when a dull or polished finish is required.

If a dull finish is required, the finish coat of varnish, after thoroughly drying, is rubbed down with very finely powdered pumice sprinkled on a felt pad and soaked in water.

On the other hand, if a polished surface is required, the work after having been carefully rubbed down with pumice stone and water is then polished with very finely powdered rotten stone and crude oil or sweet oil.

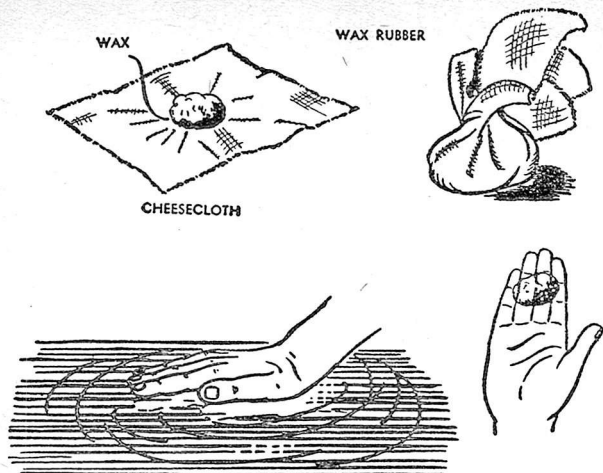
Very soft cotton waste makes an ideal polishing pad. This pad is moistened with water and then wrung as dry as possible. Rotten stone and a polishing oil, which have been thoroughly mixed together into a thin cream, is then applied to the pad and the polishing is begun. The motion is not the same as polishing, but it is a straight stroke extending from one end of the surface to the other.

After the polish has been brought to the highest point possible, its brilliancy may be deepened by rubbing rapidly with the bare hand, using the least possible quantity of oil polish, just enough to prevent the hands sticking to the finish. This rubbing by hand should be done in a circular motion.

If a greasy appearance persists after polishing, clean the polish off with a soft cloth moistened with alcohol or benzene. The greatest care must be exercised in doing this. Have but a very small quantity of alcohol on the cloth and go over the surface very lightly, using a circular motion. Do not pause or stop. If there is too much alcohol on the cloth, it is sure to burn into the varnish and destroy the polish.

Waxes are made in the paste and liquid form and of different mixtures. They are easily applied with a piece of cheesecloth or a brush, and after allowing to dry are briskly rubbed until a smooth polish is accomplished. Waxes are used on floor, linoleum, table tops, etc. Wax polishing may be done over unfilled wood or over wood filled with a paste filler, or a thin coating of shellac. The wax is applied in the form of a thin film and after being allowed to harden, it is rubbed

HOW TO WORK WITH TOOLS AND WOOD



To apply wax by hand, take a little wax on the fingers and rub vigorously.

vigorously with a piece of cheesecloth to obtain a polish. This must be done several times to secure a good gloss.

Oil polish may be used on filled or unfilled wood. Oil polish is durable and very simple to prepare. Equal parts of linseed oil and turpentine, if applied sparingly, rubbed vigorously and repeated frequently, will give a beautiful and lasting semigloss. This finish is excellent in its resistance to heat and watermarks, and is used generally on dining-room tables.

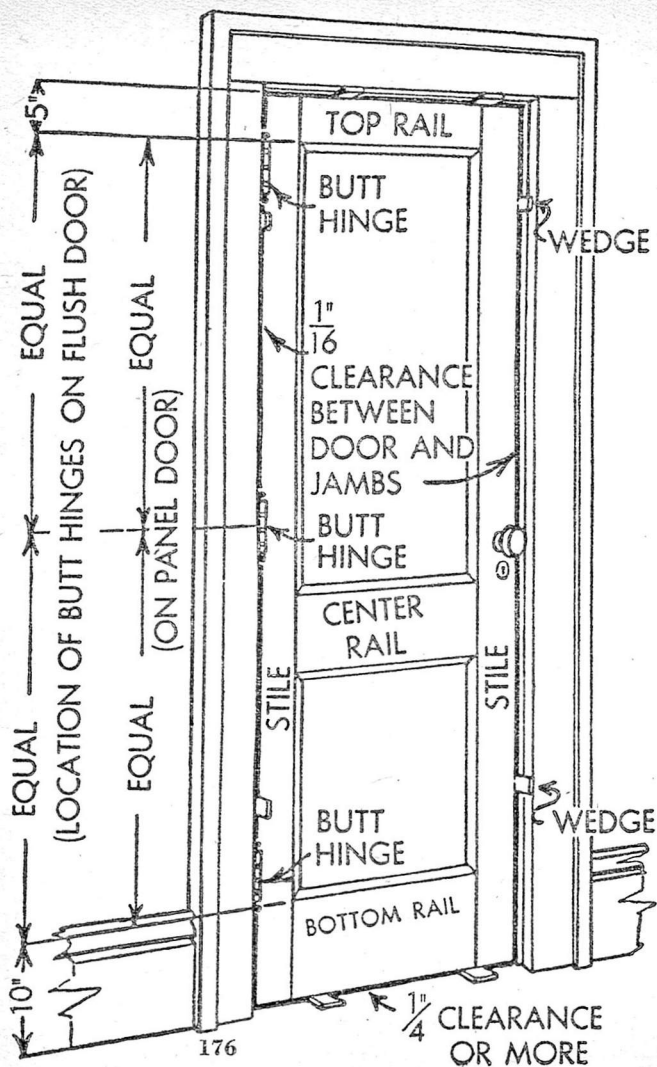
CHAPTER TWELVE

Things Around the House

WITH THE KNOWLEDGE which you already have, you should be able to make almost anything you like and also to make any repairs around the house. One of the most interesting problems which is likely to arise is the old one of hanging a door. Now that you know how to make a mortise, how to mark and gauge accurately, it should arouse no fears in you at all. For those are the problems of door hanging. The bugbear that used to reside in my mind was that of lining up the leaves of hinges. I saw very plainly that if the hinges did not line up perfectly the opening of the door would pull off either one or the other of the two. Worse yet, it might be impossible to open the door at all after I got through with it.

A door which you have made yourself or a stock door supplied by the door dealer will come to the job oversize as to width and height. Door openings in old buildings may be square and with sides perfectly parallel or they may not be, owing to settling of the building or warping and twisting of the framework. Before proceeding to work down the door to fit the opening, it is important to make sure just what kind of an opening you are dealing with. The edge of the hinge stile should be perfectly square and should be planed down smooth, removing sufficient material so that when the opposite lock stile is trimmed down the panels of the door will be about as near the jamb on the lock side as they are on the

HOW TO WORK WITH TOOLS AND WOOD



How to Hang a Door

1. Saw off lugs (the projecting ends of the stiles) at top and bottom of door.
2. Plane the butt stile to fit side jamb. Plane to the correct width of the opening at top and bottom after subtracting $\frac{1}{8}$ " for clearance, or $\frac{1}{8}$ " for clearance for each side. The lock stile should be beveled slightly.
3. Plane door to fit at the top, then scribe and plane the bottom, allowing $\frac{1}{8}$ " for clearance at the top and $\frac{1}{4}$ " or more at the bottom for rugs.
4. Wedge the door in place and mark the position of the butt hinges on the door and jamb at the same time with a knife.
5. Remove the door and square lines with the butt gauge for the length of the butt hinge or gain. Gauge the width of the gain and the depth of the gain with the butt gauge. Repeat on the jamb.
6. Chisel the gains as illustrated on opposite page.
7. Draw the pins from the butt hinges and screw one leaf to the door and one to the jamb.
8. Put the door in position and slip the pins in place.
9. If the door hangs away from the jamb, the gains should be deeper. If the door binds against the jamb, place a piece of cardboard between the butt hinge and the bottom of the gain.
10. The stop beads should then be nailed in place allowing clearance.

HOW TO WORK WITH TOOLS AND WOOD

hinge side. In other words, roughly speaking, it is desirable to have the two stiles of the finished door approximately equal in width.

After planing the hinge stile, the top should be roughly fitted to the top jamb by sawing or planing or both. In planing down the edge of the lock stile, the cut ordinarily is made at right angles to the face of the stile. You will find in the case of thick doors that it will be beneficial to finish this edge on a slight bevel rather than precisely square with the face of the door, so that the beveled portion will more readily clear the jamb when the door is opened or closed. Sometimes locks are made with beveled faces with this same idea in mind.

The bottom end of the door now is trimmed off by sawing and here it is necessary to consider whether there is a threshold or not. Where a threshold is used the door may be fitted rather closely, probably so as to swing $1/8$ inch over the threshold. Where thresholds are not used it usually is necessary to cut the door short so as to clear the floor by $1/4$ inch to $1/2$ inch, so that if rugs are used on the floor the door will swing clear of them.

When the door is properly fitted to its opening it should have about $1/16$ inch clearance on the hinge side, $1/16$ inch to $1/8$ inch on the lock side, $1/16$ inch at the top jamb, and proper clearance at the bottom, as above explained. Wedges should then be driven to hold the door in its proper position in the opening while certain measurements are taken. Measuring on the hinge stile down from the top, mark off with a sharp knife from the top jamb, on both the door and the jamb. Measuring up from the floor, make a similar mark on the door and jamb. These marks should, of course, exactly register between the door and the jamb inasmuch as all measurements for mortises are to be taken from them.

The mark from the top represents the level of the top edge of the upper hinge. The lower mark represents the bottom edge of the lower hinge. Doors will operate very much more satisfactorily if a third hinge is provided exactly midway between the other two. This third hinge not only provides additional

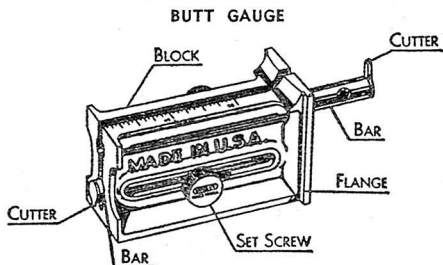
THINGS AROUND THE HOUSE

bearing and wearing areas, thus tending to prolong the life of the hardware, but has the extremely important advantage of resisting warping and springing of the door and helping the lock to maintain its proper alignment for smooth, satisfactory performance. After the three marks are made on the door and correspondingly on the jamb, the door may be removed from the opening and the proper gains made on the edge of the door and jamb for receiving the leaves of the hinges. By using a butt gauge the work of laying out the outline of the hinges may be simplified—see page 180. It is customary to cut the mortises in the door to a point $1/4''$ from the inside face, except where the door is made of very thin stock, that is, leave $1/4''$ of wood beyond the edge of the leaf.

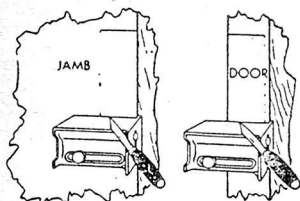
In the case of loose pin hinges, the pins may be withdrawn and the leaves of the hinges fastened in place separately on the jamb and on the door, after which the door is again put back into place, fitting the knuckles of the hinges together, whereupon the pins may be replaced in the hinges.

If the work has been accurately done and no miscalculations made, the door will swing freely. If, however, you discover there is a tendency to bind, the trouble may be corrected by loosening one of the leaves and packing with cardboard or paper or perhaps by removing one of the leaves and slightly deepening its mortise.

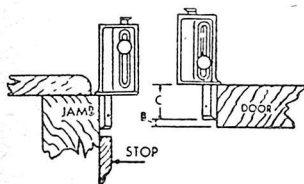
Now comes the time to fasten on your locks. The easiest



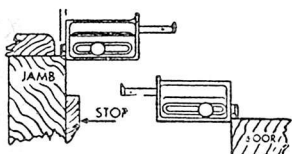
HOW TO WORK WITH TOOLS AND WOOD



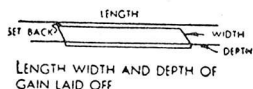
To square lines for the length of the gain, hold the flange of the butt gauge against the side of the door, or the jamb, and use it like a try square as shown in the illustration.



To gauge the width of the gain, adjust the gauge as shown for the dimension C. This is the thickness of the door less the set back B, usually $\frac{1}{4}$ ".



To gauge the depth of the gain, set the gauge for the thickness of the leaf of the butt hinge and mark the door and the jamb. The space between the leaves allows for clearance at the butt edge of the door. Most butt hinges are swaged for this clearance but some small butt hinges are straight. For straight butt hinges set the gauge for slightly less than half the thickness of the barrel.



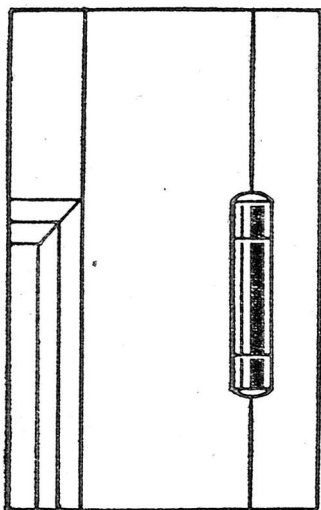
THINGS AROUND THE HOUSE

one, of course, is the rim lock, so-called because no mortise is required.

To apply a rim lock, hold the lock in place with the lock face even with the edge of the door. Mark the screw holes, the knob spindle hole, and the keyholes with an awl. Bore the holes and screw the lock into place, insert the knob spindle and attach the knobs. Screw on the escutcheon plate over the keyhole. Close the door and locate the position of the strike plate on the door jamb and screw it in place.

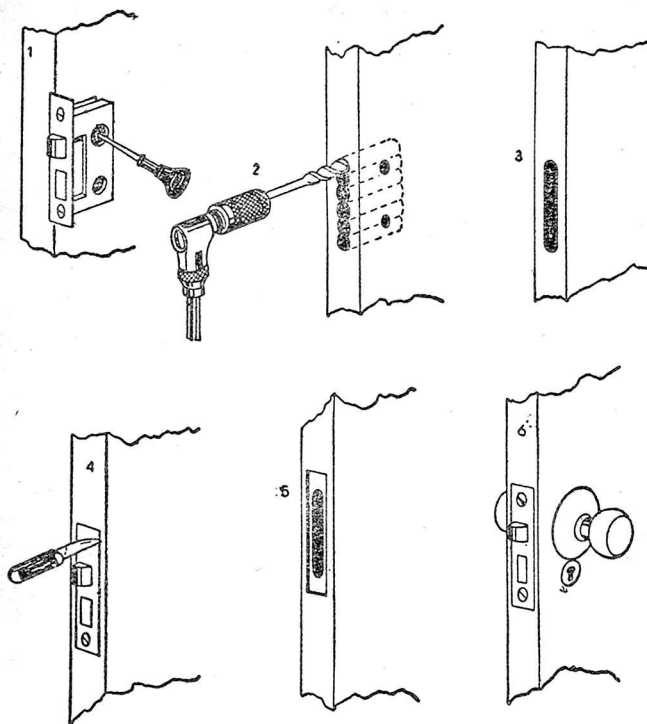
To apply a mortise lock, place it against the edge of the door with the lock face against the edge and locate the knob spindle hole and the keyhole with an awl.

Bore these holes. Draw a line in the center of the edge of the door stile parallel with the face and bore holes centering



Butts should be recessed one leaf of the hinge in the door and one in the jamb for the best application.

HOW TO WORK WITH TOOLS AND WOOD



To fit a mortise lock.

1. Hold lock face against edge of door. Mark for length of mortise, knob spindle and keyholes. Bore them.
2. On center line bore out mortise.
3. Chisel sides of mortise.
4. Insert lock and mark sides of gain with a knife.
5. Chisel out gain for the lock face.
6. Insert lock, screw the lock face fast, insert spindle, attach plates, escutcheons, and knobs.

THINGS AROUND THE HOUSE

on it for the mortise to receive the box of the lock. Use an auger bit the diameter of the thickness of the lock box. Trim out the mortise nicely with a chisel to straighten the sides and insert the lock.

Mark around the lock face with a knife, remove the lock and cut the gain with a chisel deep enough to make the lock face set slightly lower than the edge of the door. Screw the lock fast, insert the knob spindle, attach the knob and the escutcheon plate. It is now necessary to close the door in order to locate the vertical position of the strike plate on the jamb. Locate its horizontal distance from the edge by carefully measuring from the face of the door to the catch. Hold the plate in position and scribe around it. Cut the gain as deep as the plate is thick. The plate may now be screwed into place. With the chisel, cut out the wood back of the openings to receive the catch and bolt.

Other Jobs Around the House

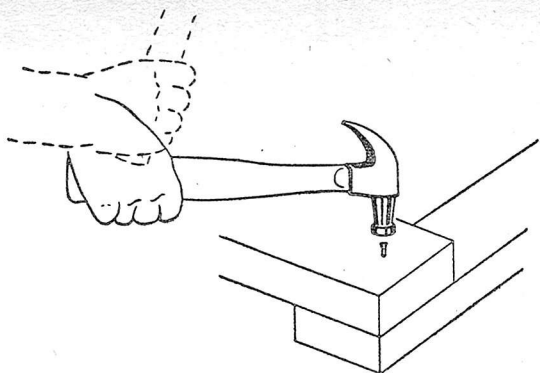
There are, of course, hundreds of tools in common everyday use which have not been described but you can become acquainted with most of them very quickly and easily at the hardware store. There you will see for instance hammers of every type, innumerable files and rasps; there are axes and mauls, mallets and sledges. All of them, of course, have a little bit of technique of their own, technique that comes quickly when the need arises and you have work for the tool to do.

But there are only a few things left which are of great importance to the amateur shop worker on which some tips might be valuable. Take the matter of using a hammer. I remember an apprentice who worked for days attempting to learn how quickly and efficiently to drive nails, yet it is a simple thing which you undoubtedly have already learned.

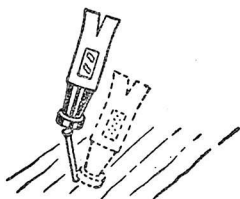
In driving nails, steady the nail with the left hand and with the right hand grasp the hammer handle firmly at the end.

At first give a slight tap to set the nail and also to determine

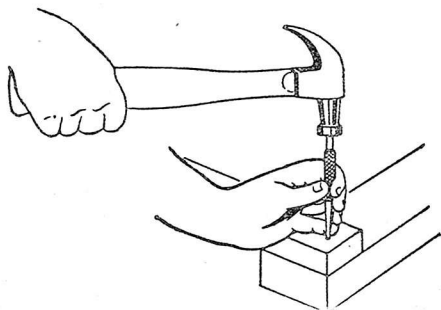
HOW TO WORK WITH TOOLS AND WOOD



The hammer stroke in driving nail.



Strike the nail squarely to avoid bending the nail and denting the wood.



Set the nail head below the surface of the wood.

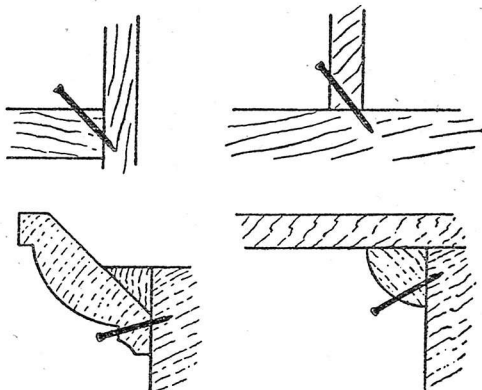
THINGS AROUND THE HOUSE

the aim. The blows that follow should be precise and well directed, with a motion chiefly of the wrist and forearm.

Be careful to strike the nail squarely on the head. A glancing blow is never good; the hammer may slip and dent the wood, or the nail may bend. When driving finishing nails, drive them all but flush with the wood.

In finishing, use a nail set to drive the nail head below the surface of the wood. This is particularly important when driving nails in moldings, in corners or when toenailing.

A little putty may be used to fill the nail hole after setting the nail below the surface.



NAIL SET

Use the nail set to finish driving nails in corners and on moldings, etc., where the hammer might disfigure the wood.

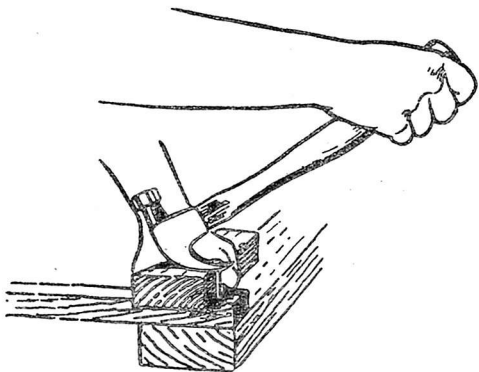
HOW TO WORK WITH TOOLS AND WOOD

There is no secret in pulling a nail. Grasp the hammer handle firmly and tilt it forward with the claws away from you. Work the hammer claws about the nail with a very slight sidewise movement of the hammer for a secure grip. Then give a firm, steady pull until the nail is withdrawn.

In drawing an extra long nail, place a small block of wood under the head of the hammer. This gives a greater leverage in pulling, and protects the wood from injury.

There is, as a matter of fact, even a trick in using the wiggle nail or corrugated fastener. This little device can be used for tightening up loose joints or cracks in chairs, tables, screen doors, window frames, flower boxes, and other similar things around the house. It is a nail which has a good deal of strength for holding two surfaces together side by side.

It should be driven by light blows with a medium-weight hammer. Each blow should be evenly distributed over the top or driving end so that it enters the wood evenly. It must also

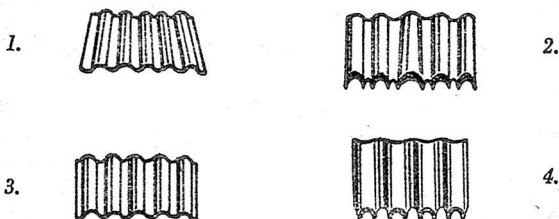


Save the hammer handle and avoid disfiguring the surface of the wood by placing a block under the hammer head when withdrawing nails.

THINGS AROUND THE HOUSE

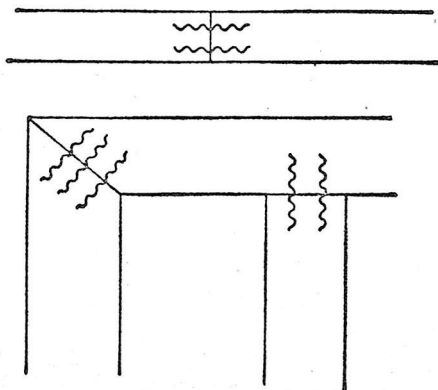
be driven on a surface which does not vibrate. You may want to put something heavy or solid behind or under the work to brace it.

The wiggle nail is made with plain edges for hard wood and saw edges for the soft woods. Manufacturers of furniture and boxes use enormous quantities. They are inexpensive and will do a job quickly and easily that would otherwise require expert work.



Corrugated fasteners.

1. *Divergent corrugations with plain edge.*
2. *Divergent corrugations with saw edge.*
3. *Parallel corrugations with plain edge.*
4. *Parallel corrugations with saw edge.*



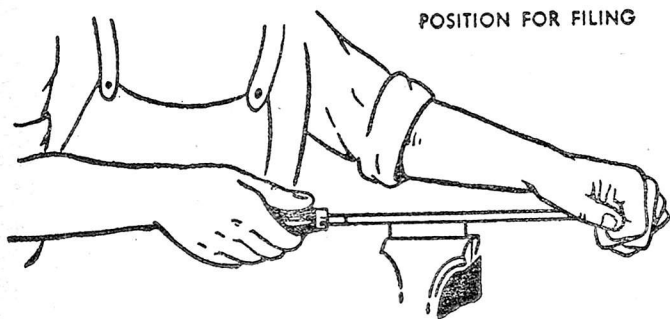
HOW TO WORK WITH TOOLS AND WOOD

Every carpenter uses a rasp or woodworker's file on wood and a regular file for work on his tools. But filing woodwork is usually not considered good practice. Files are used to enlarge round holes and also to finish curved work that has been sawed near to the line. To the craftsman this is allowable only when the work is exceedingly difficult to reach with a chisel or spokeshave.

In filing, the work should be held on a line about the height of the worker's elbow. The handle should be grasped in the right hand, against the fleshy part of the palm, with the thumb extending on top. The point of the file should be held with the thumb and first two fingers of the left hand, with the thumb on top. A file is made to cut in one direction, therefore the pressure should be on the forward stroke.

The finishing cuts on long, narrow work should be made with the file held at a right angle across the work, and moved back and forth. This is called draw filing. (See illustration on opposite page.)

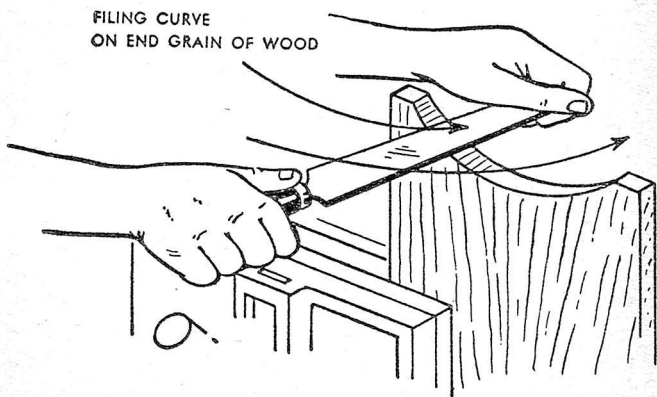
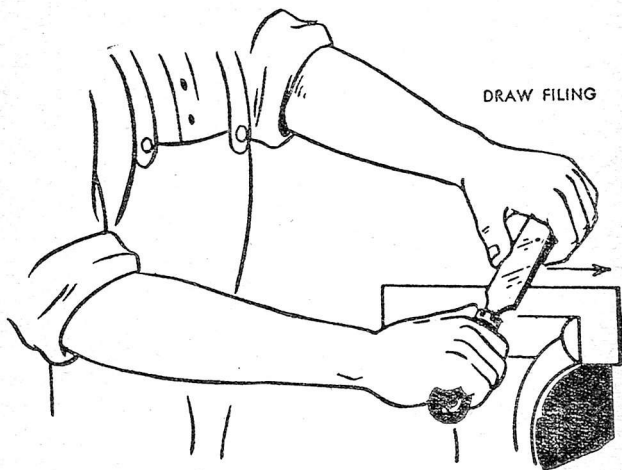
In filing a curve use a sweeping motion diagonally across the grain to avoid making grooves and hollows in the work. This also tends to prevent chipping both edges. Drawing at bottom half of page 189 shows how to file a curve.



THINGS AROUND THE HOUSE

The teeth of a file are delicate and easily broken. Careless handling of files will dull them.

The oil on a new file may be removed by covering it with chalk or charcoal before using.



HOW TO WORK WITH TOOLS AND WOOD

Files will last much longer if they are cleaned with a file card or brush every time they are used. This does not sharpen the file but will restore its usefulness.

It is well to suit the file to the work in hand.

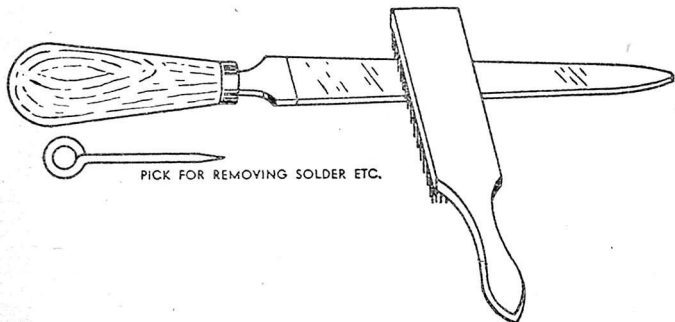
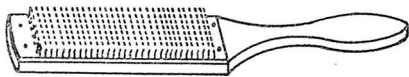
New files should be used on brass, bronze, or cast iron that need keen cutting. Use a file holder on narrow work, in draw filing, on rough castings, wrought iron, steel and hard metals.

In making things around the house by far the most important thing after you have had some practice and have learned the general principles of chiseling and boring holes and planing is the actual making of the design before you attempt to make the object.

This has already been discussed but before dropping the matter finally let us once more emphasize that more wood is botched, more tempers are tried, by proceeding without a design than by lack of skill.

And the other important thing is the tools themselves and the shape in which you keep them.

TEMPERED STEEL WIRE FILE CARD FOR CLEANING FILES



THINGS AROUND THE HOUSE

It is impossible to economize on tools and produce work which will give you the satisfaction to which the woodworker is entitled. It is far better to work with one plane, one saw, one chisel and a few accessories, all of them good, honest steel, properly sharpened, than it is to have a cellar full of inadequate devices. A good hammer and a good free swing will drive a nail home straight and true. A tap with the nail set and the job is done and done to stay. A few strokes with a plane, properly held, and your edge is square, smooth, and true. You have something from which to work. But without that good tool you have nothing. You cannot produce even the simplest bathroom shelf.

Whether you are sawing a thin board that requires no effort, or a large piece of timber, a good tool is essential. Properly treated, carefully kept sharp, a saw or a chisel, a plane or a brace and bit, will last a lifetime. It will always do good work.

And remember—mark and gauge carefully; use good sharp tools and well seasoned wood; work carefully, little by little, a stick at a time. Respect your design, keep closely to it.

Working with tools and wood is a hobby packed with romance and tradition. There is a special kind of delight in making the sturdy colonial furniture in the same way as the early American settlers did. The craftsmanship of Chippendale, Hepplewhite, Duncan Phyfe, and other masters, takes on new meaning as you strive to reproduce their work. Every kind of wood that you use has a charm and story of its own, and the tools that you use have a history which extends back to the crude implements used many generations ago.

There are unlimited, interesting possibilities in woodworking. In this book, I have tried to give you the fundamentals to help you start on the right track. It may be that wood carving, reproducing of antiques, making model boats, trains or airplanes, building furniture for your home, will catch your fancy. No matter if you make one or many kinds of things, every article you make is a new and complete diversion. Into it will go your thought and your individuality, all of which

HOW TO WORK WITH TOOLS AND WOOD

help to identify that article as distinctly yours. In detail, it will be unlike anything else, for it is rare that two pieces of handwork are ever exactly alike.

Begin in a modest way. Each new experience and success will inspire your ambition to carry on to a greater degree of accomplishment. Your appreciation of woodworking as a hobby will grow in proportion to your effort. Your workshop will become a happy haven in which you can relax from everyday care and work.

Remember that the full extent of enjoyment you will obtain from any hobby is dependent upon the amount of your own personality you put into it.

The result of your effort will reward you ten times over.

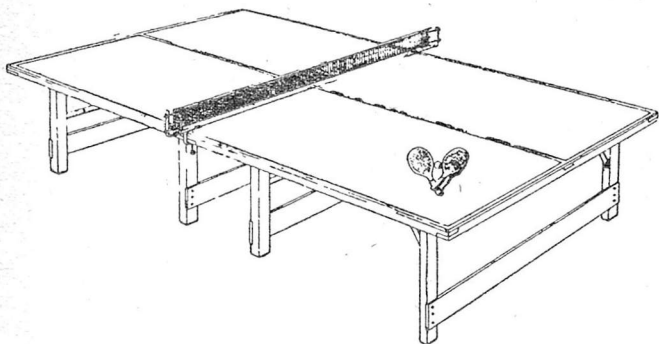
APPENDIX

Working Drawings
for Nine Things to Build

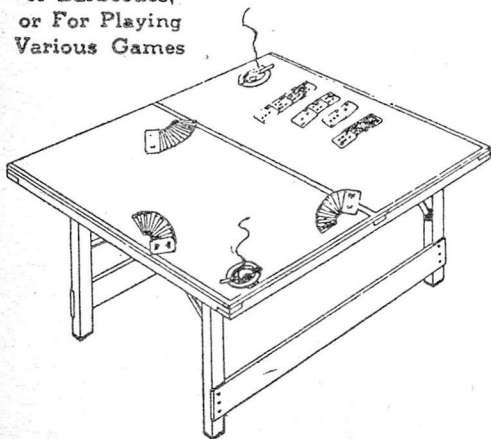
Selecting Tools
for a Home Workshop

Index

BUILD A FOLDING TENNIS TABLE



One-half Section
for
Serving Lunches
or Barbecues,
or For Playing
Various Games



One Section
Folded For
Storage



HOW TO BUILD—Made in two sections so one-half the table may be used for other games or for food serving or display purposes, etc. See plans next page. These tables close to a compact size for storing and are conveniently handled. With the Stanley Leg Braces #446 you can readily construct this sturdy table for your recreation or rumpus room in your home or for many other purposes. The two tables are held together with the Stanley Hinges #813. To take them apart the Bent Loose Pin of this hinge is simply withdrawn.

Order This Material from Your Lumber Dealer

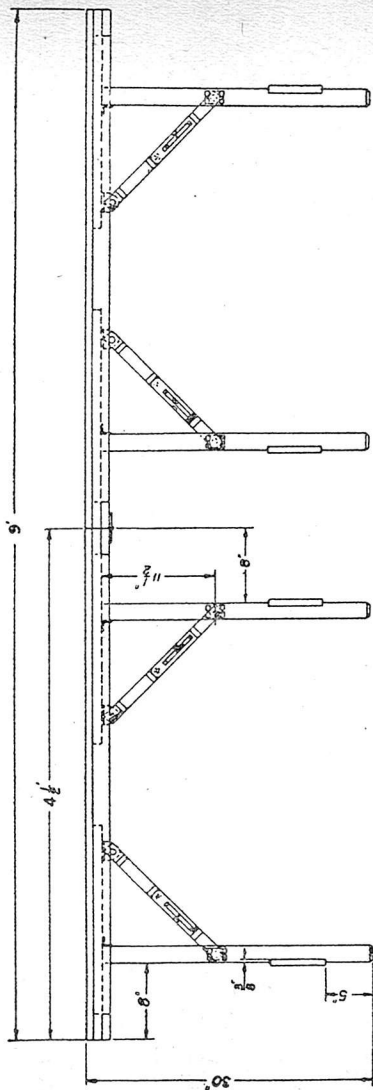
- 2 pc's— $\frac{3}{4}$ " x $4\frac{1}{2}$ ' x 5' plywood made especially for 5' x 9' regulation size table tennis.
- 7 pc's—2" x 3" x 10' D4S Pine (D4S means dressed four sides). Cutting Sizes: 6 cleats under top $4\frac{1}{2}$ ' long, 4 cleats under top 5' long, (*Note: Make sure to cut a 5' length out of four of the seven pieces*), 8 legs $28\frac{1}{2}$ " long.
- 2 pc's—1" x 6" x 16' D4S pine. Cutting Sizes: 2 leg rails 44" long, 2 leg rails 54" long, 8 leg pads 20" long.

Order This Material from Your Hardware Dealer

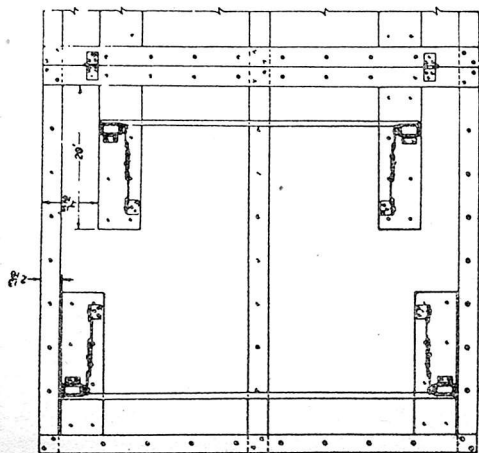
- 4 pair Hinges—Stanley #814 $\frac{1}{2}$ -2" for the Legs.
- 5 doz. Screws— $\frac{3}{4}$ " #8 Flat Head bright for the Hinges.
- 4 pair Leg Braces—Stanley #446 (regularly packed with screws).
- 1 gr. Flat Head bright wood Screws $2\frac{1}{4}$ " #12 for top cleats.
- 1 gr. Flat Head bright wood Screws $1\frac{1}{4}$ " #10 for leg pads and rails.
- 1 pair Hinges—Stanley #813— $1\frac{3}{4}$ ", for holding tables together.

Directions—All cleats for the top have a half lap joint at each corner and at the ends of the center cleat as indicated. These should be fastened to the top with two $2\frac{1}{4}$ " #12 Flat Head Screws at each joint and one every 6" between. The leg pads are fastened as indicated with eight $1\frac{1}{4}$ " #10 Flat Head Screws each. Leg rails should be carefully notched into the legs which makes for strong construction. Use three $1\frac{1}{4}$ " #10 Flat Head Screws on each leg. Countersink holes for all screws. Glue—for cleats, pads, and leg rails may be used for a stronger construction. Top should be shellacked and then painted green with a painted white stripe 1" wide around all outside edges of the table when locked together, also a 1" stripe through the middle of the 9' length dividing the 5' width equally. Scotch tape for masking will prove handy when striping.

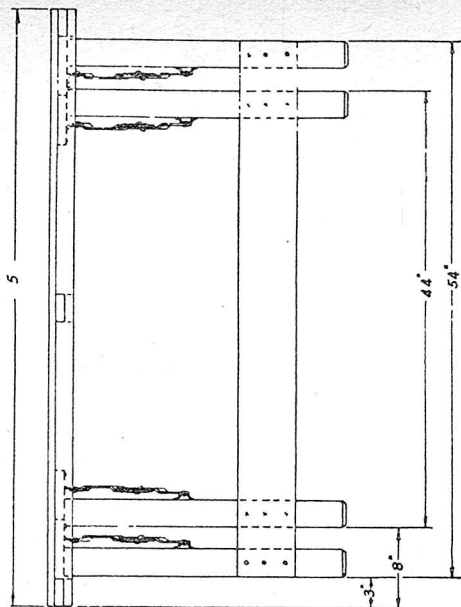
DETAIL DRAWINGS OF FOLDING TENNIS TABLE



SIDE VIEW

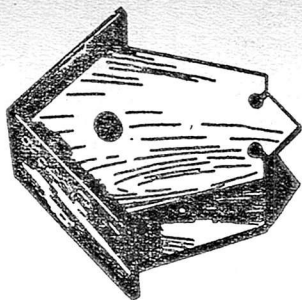


BOTTOM VIEW

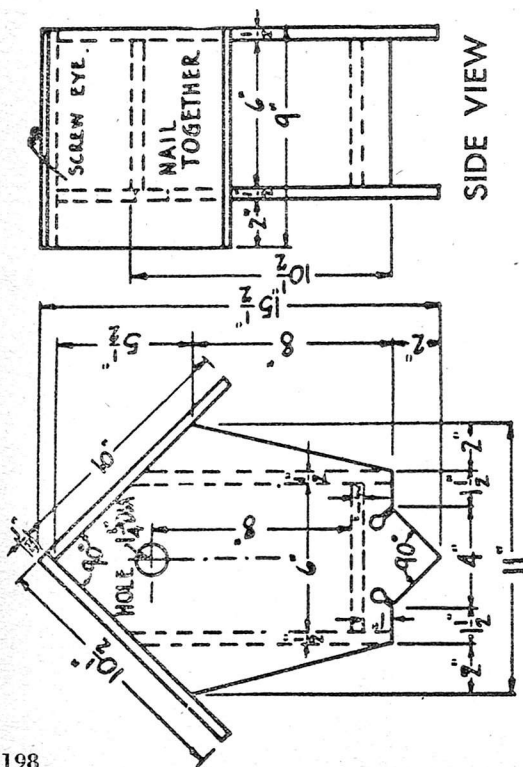


END VIEW

BIRD HOUSE



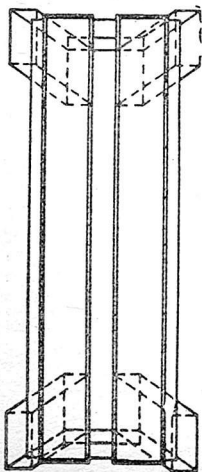
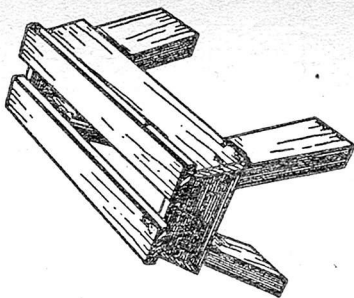
FOR BLUE BIRD



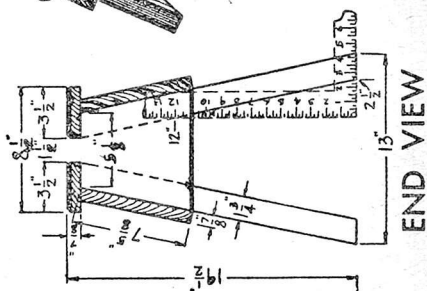
NOTE
SCREW ROOF IN PLACE TO
PERMIT CLEANING. USE
1 1/4" #6 F.H. BRASS SCREWS

FRONT VIEW

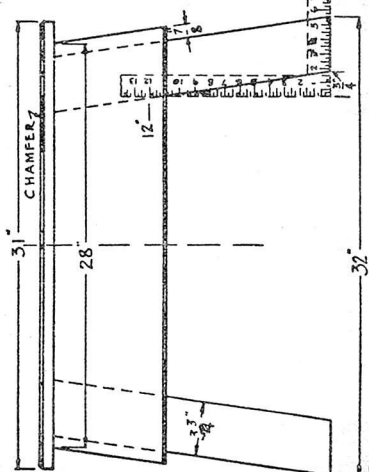
SAWHORSE



TOP VIEW

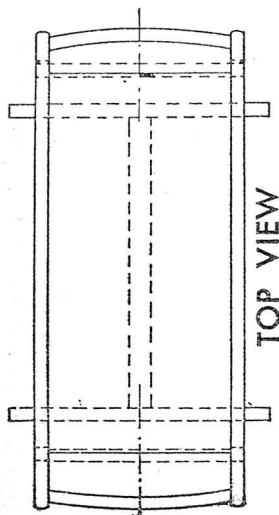


END VIEW

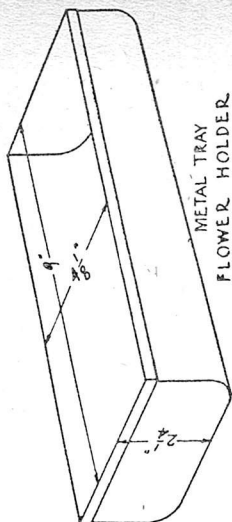
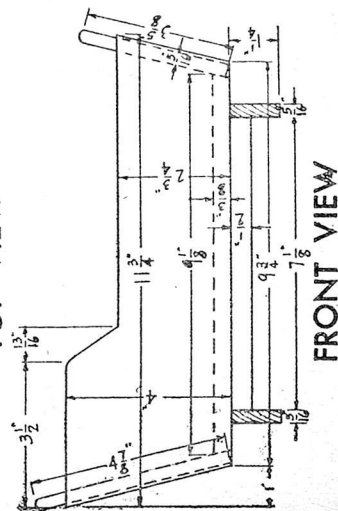


SIDE VIEW

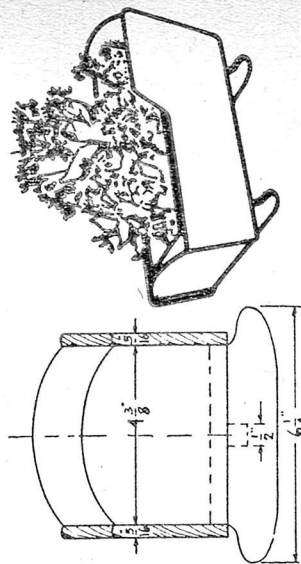
MINIATURE CRADLE



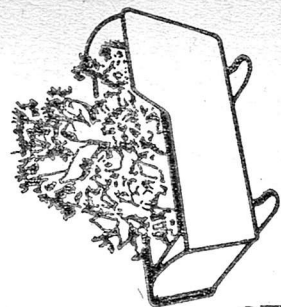
TOP VIEW

METAL TRAY
FLOWER HOLDER

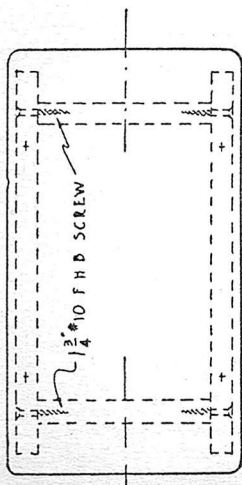
FRONT VIEW



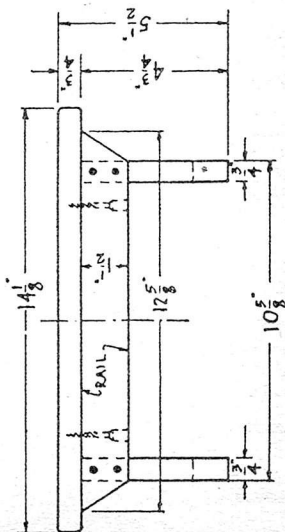
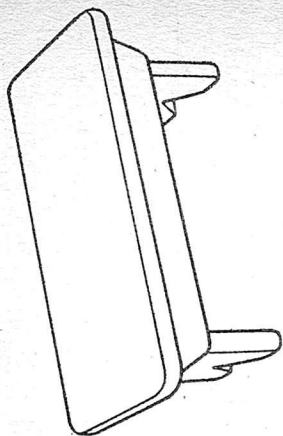
END VIEW



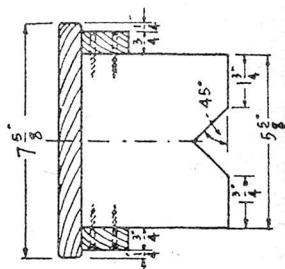
FOOTSTOOL



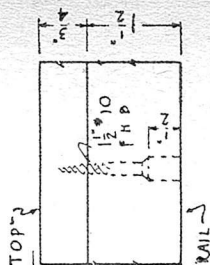
TOP VIEW



FRONT VIEW

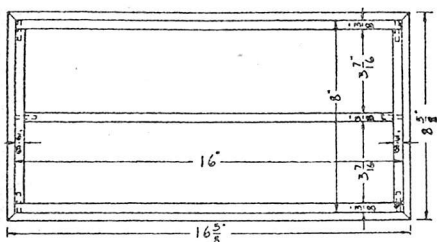
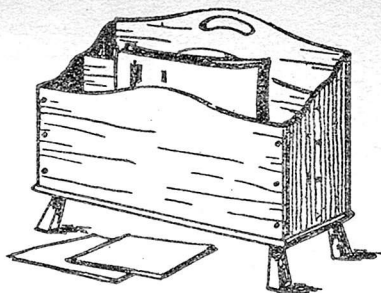


SIDE VIEW

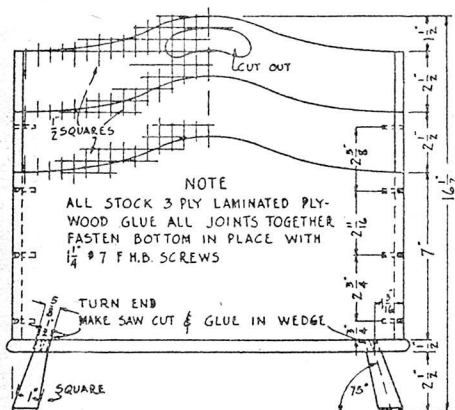


CONSTRUCTION OF
THE TOP AND RAIL.
OR GLUE & NAIL

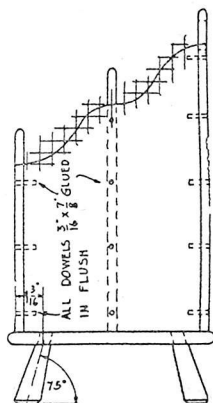
COLONIAL MAGAZINE CASE



TOP VIEW

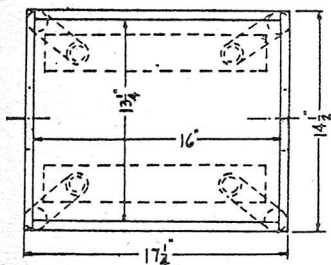
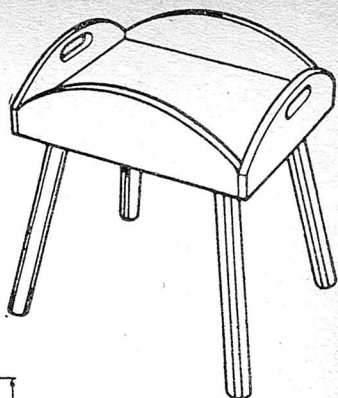


FRONT VIEW

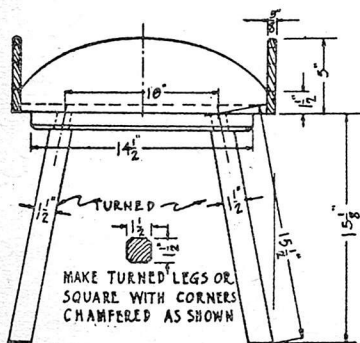


SIDE VIEW

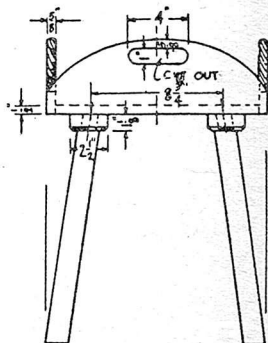
COFFEE TABLE



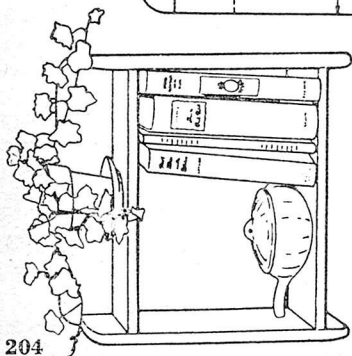
TOP VIEW



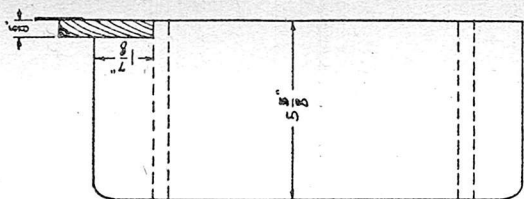
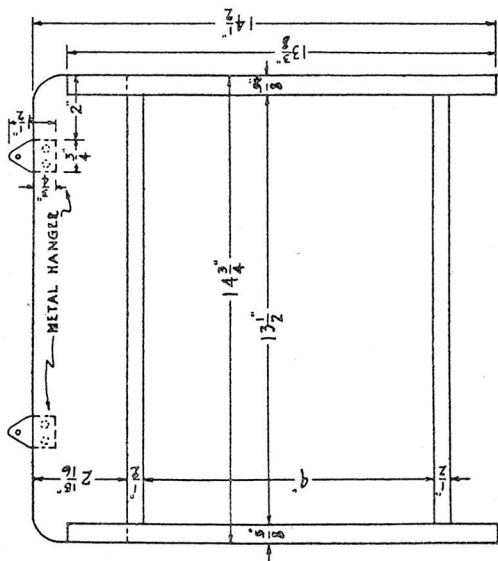
FRONT VIEW



SIDE VIEW



BOOK SHELF



Selecting Tools for a Home Workshop

WHEN YOU START a home workshop, you may be in doubt as to which tools you should purchase first. To help you make a proper selection, we have compiled a list of tools needed for woodworking. These are available from your hardware dealer.

The expense of purchasing the right tools will not be too great if you begin with the minimum set we have classified as Primary Tools. The other tools listed may be added as the need presents itself.

Be sure you get good tools. A tool that is designed and made right will give you confidence as you use it, and it will last longer. Manufacturers put their names on quality tools and make every effort to guard against defects in material and workmanship. This assurance of quality is well worth the small difference in price.

Good tools, like good friends, wear well. So select your tools carefully, and gradually add to your set as required.

Primary Tools

Items starred are the tools recommended for persons living in an apartment and who want just a few tools for handy repairs, such as putting up cup hooks, curtain rods, an occasional shelf, etc.

HOW TO WORK WITH TOOLS AND WOOD

Stanley No.

Stanley No.

*1 Nail Hammer 13 oz. .	52	1 Knife	199
1 Combination Square		1 Block Plane 6"	118
12"	122 or 21	1 Auger Bit Gauge ..	47 or 49
*1 Screw Driver 4" blade	20	*1 Screw Driver 6" small	
1 Marking Gauge	65	blade	45
1 Jack Plane 14"	5	*1 Hand Drill 1/4" chuck	.1610
or		*1 pr. Combination Pliers	
*1 Junior Jack Plane		6" .....	..
11 1/2"	5 1/4	*1 Woodworkers Vise ...	700
1 set (13 pcs.) Auger		Work bench, equipped	
Bits 1/4" to 1"	100	with woodworking vise,	
(Russell Jennings)		practical sizes:	
1 Ratchet Brace 8"		60" long x 24" wide x	
sweep	923	32" high .....	..
or 10" sweep	923	52" long x 22" wide x	
1 each, Chisels, sizes		32" high .....	..
1/4", 3/8", 1/2", 3/4", 1",		42" long x 22" wide x	
1 1/4"	60	32" high .....	..
1 Combination Oil Stone		1 Coping Saw, with extra	
fine and coarse 8" x		saw blades .....	..
2" x 1" .....	..	1 Screw Driver, small 3"	
1 Oiler .....	..	blade	146
1 each Nail Set 2/32"		1 Screw Driver, large 6"	
and 4/32" tips	11 3/4	blade	20
*1 Brad Awl 1 1/2" blade .	17	1 Screw Holding Screw	
1 Rule 2' folding	61	Driver, 6"	415
*1 Rule 6' Pull-Push ...	6386W	1 pr. Dividers 8"	58
or		1 Smooth Plane 9" (or 8"	
1 Rule 6' Zig-Zag	126 or 106	No. 3)	4
*1 Hand cut off Saw 24"		1 Steel Square 24" x 16"	100
—10 pt. ....	..	1 T Bevel 8" blade	18
1 Hand rip Saw 26"—5		1 Cabinet Scraper	80
pt. ....	..	1 Burnisher	185
or 24" may be		1 Half Round Cabinet	
desired .....	..	Rasp 10" .....	..
1 Hand Back Saw 10" or		1 Half Round Cabinet	
12"—14 pt. ....	..	File 10" .....	..

SELECTING TOOLS FOR A HOME WORKSHOP

Stanley No.

Stanley No.

1 Smooth Mill File 10"	1 Level 24"	23
1 Auger Bit File	1 Draw Knife 10" .....	..
1 Slim Taper saw File 8" ..	1 Ripping Bar 18"	118
1 Round Bastard File 10" ..	1 Jointer Plane 22"	7
1 Flat Bastard File 10" . ..	or Fore Plane 18" ..	6
6 File Handles for above . ..	1 Rabbet Plane	78
1 Wire Filecard	1 Router Plane	71
1 "Yankee" Automatic	1 Scrub Plane	40
Drill	1 Combination Plane (23	
1 "Yankee" Spiral Screw	cutters)	45
Driver	or	
1 Expansive Bit, large	1 Larger Unit (55 cutters)	55
size, capacity $\frac{7}{8}$ " to	1 Plumb Bob .....	..
$2\frac{1}{2}$ " with extra cutter	1 Saw Set	42
(Russell Jennings) ...	1 Compass Saw 14" .....	..
1 each Bit Stock Drill with	1 pr. Tinner's Snips 10" . ..	..
square shank, $\frac{1}{8}$ ", $\frac{3}{32}$ ",	1 "Yankee" Vise with	
$\frac{1}{8}$ ", $\frac{5}{32}$ ", $\frac{1}{8}$ ", $\frac{3}{32}$ "	swivel base	1992
1 each Straight Shank	1 Pipe Wrench Stillson	
Carbon Drills for hand	type 14" .....	..
drill, $\frac{1}{8}$ ", $\frac{5}{32}$ ", $\frac{3}{32}$ ", $\frac{7}{32}$ ",	1 Monkey Wrench 8" ... ..	..
$4/32$ ", $\frac{9}{32}$ ", $\frac{5}{16}$ ", $\frac{11}{32}$ " ..	1 Open end Wrench 8" .. ..	..
1 Countersink $\frac{3}{4}$ " (for	1 Putty Knife .....	..
Bit Brace)	1 Scratch Awl	6
1 Countersink — Round	1 Spoke Shave	151
Shank (for Hand	1 Spoke Shave convex	
Drills)	bottom	63
1 Mallet 3" face	1 Electric Grinder 7" x	
1 Dowel Jig with 6 guides	1" wheels for plane irons	
2 Screw Driver Bits $\frac{5}{16}$ ",	and chisels and general	
$\frac{3}{8}$ "	grinding, 110 A.C. 60	
3 Gouges, outside bevel,	cycles	677
$\frac{1}{4}$ ", $\frac{1}{2}$ ", 1"	or Grinder	H56
1 Half Hatchet	1 Electric Drill $\frac{1}{4}$ " Chuck	H21
1 Nail Hammer 7 oz.	1 pr. Trammel Points ...	4
1 Nail Hammer 16 oz. ..	1 Soldering Iron, electric	340
1 Riveting Hammer 4 oz.	1 Caliper Rule, 1'	36 $\frac{1}{2}$

HOW TO WORK WITH TOOLS AND WOOD

Stanley No.

Stanley No.

1 Cold Chisel $\frac{3}{4}$ "	74	1 Glass Cutter	
1 Mortise Gauge	98	1 Bench Duster	
1 Center Punch $\frac{5}{8}$ " tip ..	10	2 C Clamps 4"	
2 Cornering Tools ..28 and 29		2 C Clamps 8"	
1 Dowel Sharpener	22	2 Adjust. Hand Screws 6"	
1 Hammer Ball Pein 12 oz.	309	Jaws	
1 Hammer, Upholsterer's	601	2 Adjust. Hand Screws 8"	
1 Mitre Box with 26" saw	2246	Jaws	
1 Hack Saw adj. and 6		2 Adjust. Hand Screws	
12" blades	10" Jaws	
1 Dovetail Saw 6" blade .	..	2—4' and 2—6' Bar Clamps	

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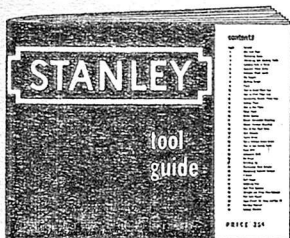
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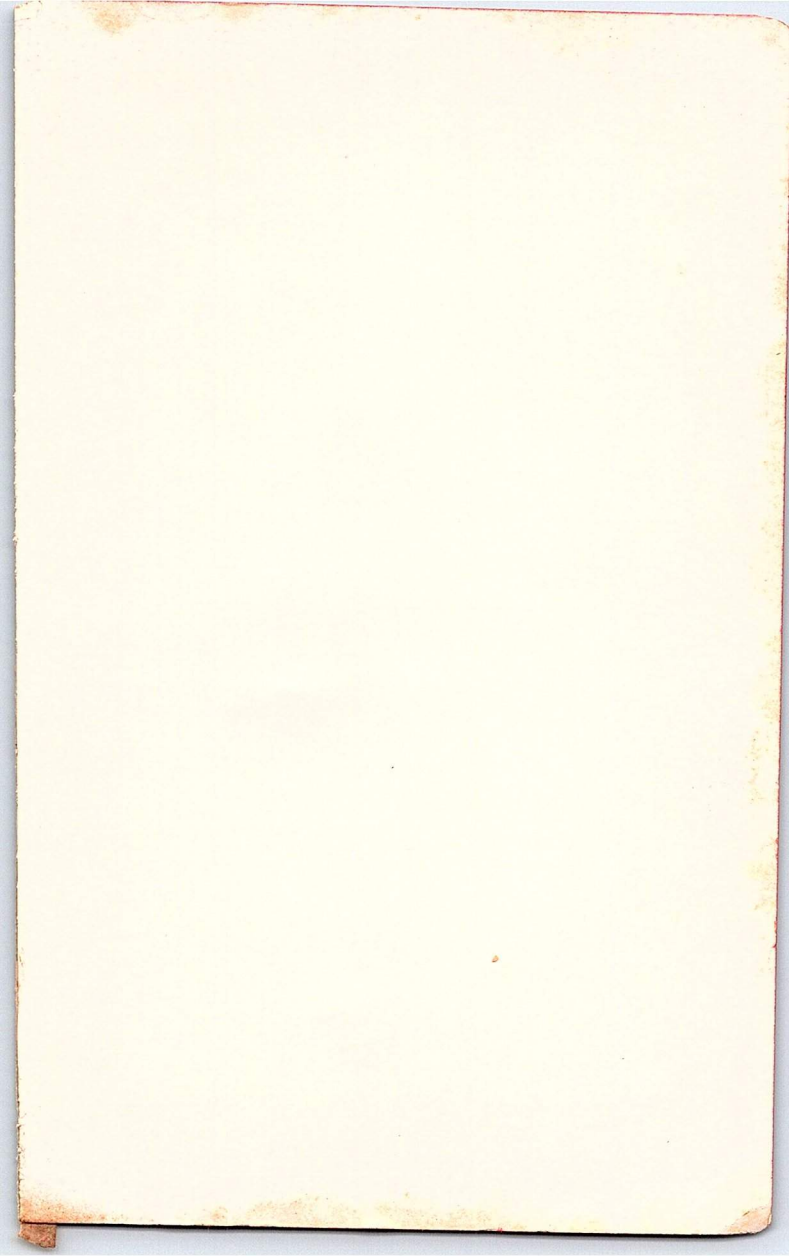
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